INSTRUCTION BOOK

RDR-1 AIRBORNE RADAR SYSTEM
Type RDR-1C (C-band, 5.5cm)
TRANSMITTER-RECEIVER

BENDIX RADIO
DIVISION OF BENDIX AVIATION CORPORATION
BALTIMORE 4, MARYLAND

I.B. 738
Preliminary

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TABLE OF CONTENTS

Paragraph		Page
	SECTION I--GENERAL DESCRIPTION	
1-1	GENERAL	1-1
1-2	FUNCTION OF EQUIPMENT	1-1
1-3	DESCRIPTION OF EQUIPMENT	1-2
	a. Electrical	1-2
	b. Mechanical	1-3
1-4	EQUIPMENT SUPPLIED	1-4
1-5	EQUIPMENT REQUIRED BUT NOT SUPPLIED	1-5
1-6	SUMMARY OF SPECIFICATIONS	1-5
	SECTION II--THEORY OF OPERATION	
2-1	GENERAL	2-0
2-2	CONTROL CIRCUITS	2-0
	a. General	2-0
	b. "STANDBY" Attitude	2-0
	c. "ON" (Operating)	2-2
2-3	PROTECTIVE DEVICES	2-3
	a. Time Delay Relay K3001	2-3
	b. Overload Relay K3004	2-4
	c. Spark Gap	2-6
	d. Fuses	2-6
2-4	HIGH VOLTAGE POWER SUPPLY	2-6
	a. General	2-6
	b. Input	2-6
	c. Output	2-7
2-5	MODULATOR-TRANSMITTER SECTION	2-7
	a. General	2-7
	b. Charging Circuit	2-7
	c. Discharge Circuit	2-8

Table of Contents

Paragraph		Page
2-6	MAGNETRON OSCILLATOR	2-9
	a. General	2-9
	b. Input	2-9
	c. Output	2-11
2-7	SWITCH DRIVER CIRCUIT	2-12
	a. General	2-12
	b. Charging Circuit	2-12
	c. Timing	2-12
2-8	DUPLEXER-MIXER ASSEMBLY INCLUDING LOCAL OSCILLATOR	2-12
	a. General	2-12
	b. ATR Tube	2-14
	c. TR Tube	2-14
	d. Mixer Section	2-17
	(1) Signal Mixer	2-17
	(2) AFC Mixer	2-17
	e. Local Oscillator	2-18
	f. Directional Coupler	2-18
2-9	AFC CIRCUIT	2-19
	a. General	2-19
	b. Input	2-19
	c. Discriminator	2-20
	d. Pulse Amplifier	2-22
	e. Clamp Circuit	2-22
	f. Sweep Generator Circuit	2-24
	g. AFC Sweep Adjustment	2-29
2-10	RECEIVER	2-29
	a. General	2-29
	b. I-F Amplifier Section	2-32
	(1) Input	2-33
	(2) STC Circuit	2-34

Paragraph		Page
	(3) Manual Gain Controlled I-F Amplifier Stages	2-36
	(4) Conventional I-F Amplifier Stage	2-36
	(5) Detector	2-36
	c. Video-Contour Amplifier Section	2-37
	(1) Normal Operation, Contour "OFF"	2-39
	(2) Contour Operation	2-39
2-11	METERING CIRCUITS	2-42
	a. Crystal Current Metering	2-42
	b. Running Time Meter	2-45
	SECTION III--INSTALLATION	
3-1	GENERAL	3-0
	SECTION IV--OPERATION	
4-1	GENERAL	4-1
	SECTION V--PREVENTIVE MAINTENANCE	
5-1	GENERAL	5-0
	SECTION VI--CORRECTIVE MAINTENANCE	
6-1	GENERAL	6-1
6-2	TEST FACILITIES REQUIRED	6-1
6-3	TEST EQUIPMENT REQUIRED	6-2
6-4	BENCH TEST SETUP	6-8
	a. Cabling	6-8
	b. Input Power Requirements	6-8
6-5	TEST PROCEDURE, MODULATOR-TRANSMITTER SECTION OF RDR-1C TRANSMITTER-RECEIVER	6-9
	a. Test Equipment Required	6-9
	b. Continuity Test	6-9
	c. Preliminary Tests	6-12
	(1) Thermal Relay Delay Time	6-14

Paragraph			Page
	(2)	Blower Motor Operation Test	6-16
	(3)	Magnetron Filament Voltage Test	6-16
	(4)	Keep-Alive Voltage Supply Test	6-18
	(5)	Transmitter Trigger Test	6-18
d.		Operating Tests	6-20
	(1)	Preparation	6-20
	(2)	Magnetron Current Test	6-20
	(3)	Transmitter High Voltage Test	6-21
	(4)	Overload Protection Test	6-21
	(5)	Corona Discharge Test	6-21
	(6)	Transmitter Pulse Width Test	6-22
	(7)	Transmitter Output Power Measurement	6-22
	(8)	Transmitter Output Frequency Measurement	6-27
e.		Summary of Minimum Performance Standards, Modulator-Transmitter Section	6-27
6-6		TEST AND ALIGNMENT PROCEDURES, RECEIVER-AFC SECTION OF RDR-1B-1 TRANSMITTER-RECEIVER	6-28
a.		Test Equipment Required	6-28
b.		Continuity Test	6-28
c.		STC Circuit Test and Adjustment	6-30
	(1)	STC Pulse Amplifier Test	6-30
	(2)	STC Pulse Width Test	6-33
d.		Cascode I-F, Alignment and Bandpass	6-33
	(1)	Alignment	6-33
	(2)	Bandpass (3 DB)	6-35
e.		I-F Strip, Alignment and Over-all Bandpass	6-35
	(1)	Alignment	6-35
	(2)	Over-all Bandpass	6-37
	(3)	Gain Test	6-38
f.		Contour Circuit Adjustment	6-39

Paragraph		Page
	g. AFC Section Adjustment	6-41
	(1) Discriminator	6-41
	(2) Pulse Amplifier Test	6-42
	h. Summary of Minimum Performance Standards, Receiver-AFC Section of RDR-1C Transmitter-Receiver	6-43
6-7	FINAL TESTS AND ADJUSTMENTS, COMPOSITE RDR-1C TRANSMITTER-RECEIVER	6-45
	a. Test Equipment Required	6-45
	b. Preparation	6-46
	c. Local Oscillator	6-46
	(1) Frequency Adjustment	6-46
	(2) Output Attenuator Adjustment	6-47
	d. AFC Lock-In (Sweep Centering)	6-48
	e. AFC Discriminator Adjustment	6-48
	f. Over-All Receiver Sensitivity Test	6-50
	g. Contour Level Adjustment	6-51
	h. STC Range Adjustment, Final	6-51
	i. Coarse Gain Control Adjustment	6-52
	j. Summary of Final Tests and Adjustments	6-53
6-8	SERVICING AIDS	6-53
6-9	CHECK LIST, SYSTEM OPERATION	6-62
	SECTION VII--SUPPLEMENTARY DATA AND MODIFICATIONS	
7-1	GENERAL	7-0
7-2	CONTOUR TEST FACILITY, ADDITION	7-0
7-3	MAGNETRON BLOWER B3002, CHANGE	7-1
7-4	THERMAL CUTOUT SWITCH S3002, ADDITION	7-2
	SECTION VIII--PARTS LIST	
8-1	GENERAL	8-1
	SECTION IX--SCHEMATIC DIAGRAMS	

LIST OF ILLUSTRATIONS

Figure		Page
1-1	RDR-1C Transmitter-Receiver, Part of RDR-1 (C-band) Airborne Radar System	1-0
1-2	RDR-1C Transmitter-Receiver Chassis Showing Receiver-Afc Sub-chassis Swung Out From Main Chassis on Mounting Hinge	1-4
2-1	Control Circuits of RDR-1C Transmitter-Receiver, Simplified Schematic Diagram	2-1
2-2	Low-Voltage and Keep-Alive Power Supplies, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-5
2-3	Modulator-Transmitter Section of RDR-1C Transmitter-Receiver Including Transmitter High-Voltage Power Supply, Partial Schematic Diagram	2-5
2-4	Reference Waveforms, D-C Resonant Charging Circuit of RDR-1C Transmitter-Receiver	2-10
2-5	Switch Driver Circuit, Part of Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-13
2-6	Duplexer-Mixer Waveguide Assembly W3001 Showing Connections to Receiver and Afc Circuits, Part of RDR-1C Transmitter-Receiver, Block Diagram and Cutaway Detail	2-15
2-7	Afc Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Block Diagram	2-18
2-8	Input Amplifier and Discriminator Section of Afc Circuit, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-20
2-9	Pulse Amplifier, Clamp, and Sweep-Generator Sections of Afc Circuit, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram and Reference Waveforms	2-23
2-10	Receiver Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Block Diagram	2-30
2-11	Input and Cascode I-F Amplifier Sections of Receiver-Afc Sub-chassis Showing STC Controlled I-F Amplifier Stage, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-31
2-12	STC Voltage Generator Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram and STC Voltage Waveform	2-31
2-13	I-F Amplifier and Detector Sections of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-32

Figure		Page
2-14	Video-Contour Amplifier Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-37
2-15	Reference Waveforms, Contour Circuit	2-38
2-16	Video Output Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram	2-41
2-17	Current Metering Circuits of RDR-1C Transmitter-Receiver, Simplified Schematic Diagram	2-43
3-1	RDR-1C Transmitter-Receiver, Dimensional Outline Drawing	3-1/3-2
3-2	SHK-1C Shockmount, Dimensional Outline Drawing	3-3/3-4
6-1	Test Bench Setup, RDR-1 Airborne Radar System (Suggested Layout), Block Diagram	6-4
6-2	RDR-1 Airborne Radar System Interconnecting Wiring Diagram Modified For Single Phase A-C Input	6-5/6-6
6-3	Auxiliary Test Equipment Construction Data and Schematic Diagrams	6-7
6-4	Front Panel of RDR-1C Transmitter-Receiver	6-13
6-5	Rear View of RDR-1C Transmitter-Receiver	6-15
6-6	Top View of RDR-1C Transmitter-Receiver Chassis With Receiver-Afc Sub-chassis in Place	6-17
6-7	Top View, Rear Section of RDR-1C Transmitter-Receiver Chassis, Receiver-Afc Sub-chassis Removed	6-19
6-8	Top View, Rear Section of RDR-1C Transmitter-Receiver Chassis, Receiver-Afc Sub-chassis and Duplexer-Mixer Waveguide Assembly Removed	6-23
6-9	RDR-1C Transmitter-Receiver Chassis, (A) Right Side View, (B) Left Side View	6-25
6-10	Top View of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver	6-31
6-11	Bottom View of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver	6-32
6-12	Top and Bottom Views of Duplexer-Mixer Waveguide Assembly, Part of RDR-1C Transmitter-Receiver	6-49
6-13	Electrical Components of RDR-1C Transmitter-Receiver, Schematic Diagrams and Test Data	6-66

Table of Contents

Figure		Page
6-14	Reference Waveshapes	6-67
7-1	Modification to RDR-1C Transmitter-Receiver Showing Capacitor C3014 and Switch S3002 Additions, Partial Schematic Diagram .	7-3
7-2	Modification to RDR-1C Transmitter-Receiver Showing Wiring Differences For Blower Motor B3002 and Phasing Capacitor C3008, Partial Schematic Diagram	7-4
8-1	Duplexer-Mixer Waveguide Assembly W3001, Part of RDR-1C Transmitter-Receiver, Exploded Views	8-22
9-1	Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Schematic Diagram	9-3/9-4
9-2	Receiver-Afc Section of RDR-1C Transmitter-Receiver, Schematic Diagram	9-5/9-6

REPRODUCIBLE DIAGRAMS

Drawing Number		Section
	SCHEMATICS	
OR669785	Modulator-Transmitter Section of RDR-1C Transmitter-Receiver .	9
OR669789	Receiver-Afc Section of RDR-1C Transmitter-Receiver	9

LIST OF TABLES

Table		Page
1-1	Equipment Supplied	1-5
1-2	Tube Complement for RDR-1C Transmitter-Receiver	1-6
6-1	Test Equipment Required--RDR-1 (C-band) Airborne Radar System	6-3
6-2	Trouble-Shooting Chart, RDR-1C Transmitter-Receiver	6-54
6-3	Tube Socket Voltages, Receiver-Afc Chassis	6-59
6-4	Tube Socket Resistances, Receiver-Afc Chassis	6-60

Table		Page
6-5	Index, Component Schematic and Test Data	6-61
6-6	System Operation Check List	6-62

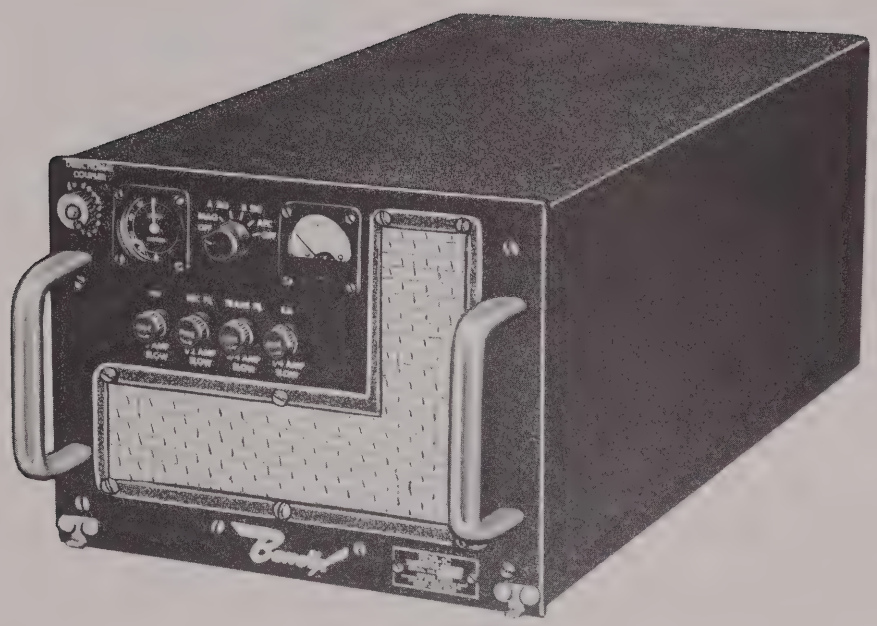


Figure 1-1. RDR-1C Transmitter-Receiver, Part of RDR-1 (C-band) Airborne Radar System

SECTION I
GENERAL DESCRIPTION

1-1. GENERAL.

The Bendix Type RDR-1C Transmitter-Receiver (figure 1-1) is a part of the Bendix Type RDR-1 (C-band), weather mapping, Airborne Radar System.

This handbook is a part of, and should be used in conjunction with, the RDR-1 (C-band) Airborne Radar System Instruction Book IB-733. Instruction Book IB-733 contains a general description and theory of operation of the system, installation instructions, and operating procedures.

This instruction book, IB-738, contains a general description of the type RDR-1C Transmitter-Receiver, circuit theory, maintenance and servicing information, and a parts list covering the electrical components of the unit.

1-2. FUNCTION OF EQUIPMENT.

The RDR-1C Transmitter-Receiver is, as its name implies, the transmitter and receiver for the RDR-1 (C-band) Airborne Radar System.

Operating in the range from 5370 to 5430 megacycles per second, the transmitter produces 2.0-microsecond pulses of microwave energy at a nominal peak pulse power of 100-kw peak for transmission at the rate of 400 ±20 pulses per second.

Echo signals are received at the transmitting frequency, converted to a 30-megacycle i-f signal in the signal mixer section of the duplexer-mixer, amplified in the i-f section of the receiver, amplified as video signals, and made available through two separate cathode-follower output circuits for operation of one or two cathode-ray tube indicators.

An ISO-ECHO contour circuit, incorporated with the receiver, makes possible the detection of storm cells within cloud formations.

1-3. DESCRIPTION OF EQUIPMENT.

a. ELECTRICAL.--The RDR-1C Transmitter-Receiver comprises a transmitter high-voltage power supply; a transmitter-modulator circuit; a duplexer-mixer waveguide assembly, including a directional coupler; receiving circuits; afc circuits; contour circuitry; a keep-alive voltage supply for the TR tube; a klystron local oscillator; metering circuits; low voltage power supplies for all tube filaments; a magnetron oscillator; a magnetron blower; a unit ventilating fan; an elapsed time meter; relay-operated control circuits; and protective devices.

The transmitter-receiver is powered with 115 volts 380-420 cps, 115 volts 300-1000 cps, and 28 volts dc (through the control circuit), from primary power sources in the aircraft. In addition, an accessory unit (the SYN-1B Synchronizer-Amplifier-Power Supply) provides 300 volts dc, 140 volts dc, and a bias voltage of -250 volts dc to complete the power requirements of the transmitter-receiver unit.

All electrical interconnections between the transmitter-receiver and the radar system are made through quick-disconnect plug P3001 on the rear of the unit. R-f (waveguide) connection is made at the rear of the unit to the duplexer-mixer output. The output flange of the duplexer-mixer is a flat-style choke flange which is readily adaptable to the use of a quick-disconnect device.

The several circuits included in the RDR-1C Transmitter-Receiver are shown in the schematic diagrams of the modulator-transmitter section (figure 9-1) and the receiver-afc section (figure 9-2).

Tubes and crystals included in the unit are listed in table 1-2 by symbol number, type number, function and description.

A summary of the electrical and physical specifications is given in paragraph 1-6.

b. MECHANICAL.--The RDR-1C Transmitter-Receiver, contained in a black, wrinkle finished, aluminum case of 1 ATR size, weighs 49.5 pounds. Overall dimensions are given in table 1-1.

The chassis is of all-aluminum construction. All components of the transmitting circuits, modulator circuits, and power supplies, along with the magnetron blower, the unit ventilating fan, metering circuits, and components of the transmitter control circuits are mounted on the main chassis.

The receiver, including afc and contour circuits, is built on an individual subchassis which is hinged to the main chassis, as shown in figure 1-2, and is secured by a captive bolt.

The duplexer-mixer (internal waveguide assembly) attaches to the main chassis and to the magnetron oscillator and is removable as a unit.

Mounted on the front panel are four fuse holders, a test jack internally connected to the directional coupler, a meter for monitoring crystal and magnetron currents, a meter-circuit selector switch, an elapsed time meter, two carrying handles, and an air filtering screen covering an L-shaped air intake port.

Two guide-pin holes, one in each lower rear corner of the chassis, are provided for positive positioning and holding the rear of the unit in its mount. Two standard L-brackets on the front panel complete the mounting hardware.

All electrical connections to the radar system are made through the back of the case. The complete chassis assembly slides into its case from the front and is secured by two screwdriver-operated Camloc fasteners in the rear of the case.

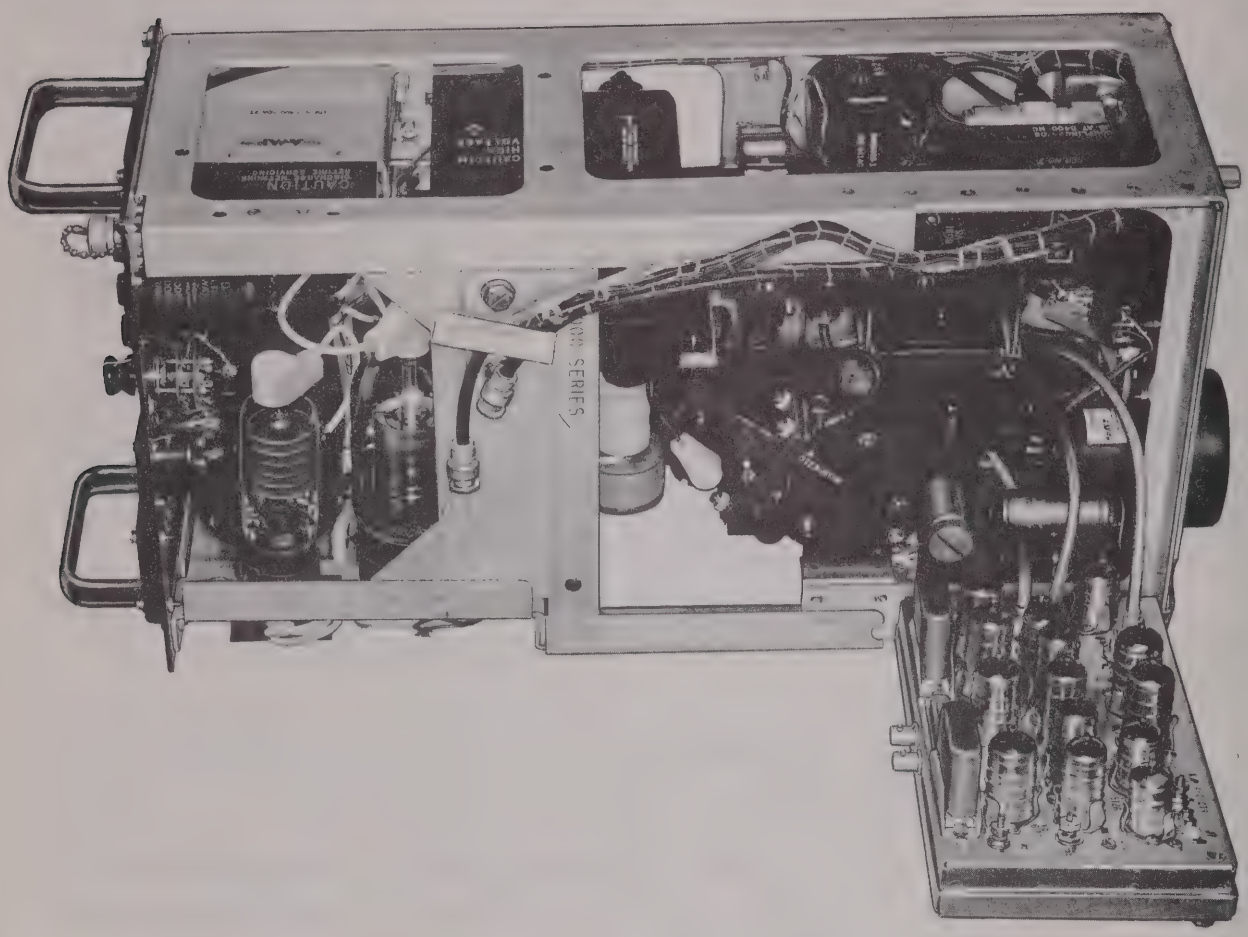


Figure 1-2. RDR-1C Transmitter-Receiver Chassis Showing Receiver-Afc Subchassis Swung Out From Main Chassis On Mounting Hinge

The unit is designed in accordance with ARINC Equipment Characteristics and provides the necessary margins of safety, performance, and mechanical ruggedness required of aircraft installations.

1-4. EQUIPMENT SUPPLIED.

The equipment supplied as a type RDR-1C Transmitter-Receiver is listed in table 1-1, together with its weight and dimensions.

TABLE 1-1. EQUIPMENT SUPPLIED

TYPE NO.	NAME	DIMENSIONS (INCHES)			WEIGHT (POUNDS)
		LENGTH	WIDTH	HEIGHT	
RDR-1C	Transmitter-Receiver	22.48	10.12	7.62	49.5

1-5. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

All other equipment and accessories required for the installation and operation of the RDR-1C Transmitter-Receiver are listed in Section I of IB-733, the Instruction Book for the RDR-1 (C-band) Airborne Radar System.

1-6. SUMMARY OF SPECIFICATIONS.

Transmitting frequency	5400 ±30 megacycles
Wavelength	5.5 cm
Pulse width	2.0 microseconds
Pulse repetition frequency	400 ±20 pps
Duty cycle	0.0008
Power output	
Peak	100 kw nominal
Average	80 watts nominal
Receiving frequency	Same as transmitted frequency
Receiver type	Superheterodyne
Type of reception	Pulse
Intermediate frequency	30 megacycles per second
I-f bandwidth	One megacycle at 3-db points, 30 megacycles center frequency
Local oscillator frequency	30 megacycles below transmitted frequency
Local oscillator frequency control	D-f (difference-frequency) principle afc

Unit designed for operation under ambient conditions of:	
Temperature	-40° to +55° C (-40° to +131° F)
Humidity	10 per cent to 90 per cent at +50° C (+122° F)
Pressures	Sea level to 16,000 feet
Tube complement	Refer to table 1-2 .
Weight and dimensions	Refer to table 1-1.

TABLE 1-2. TUBE COMPLEMENT FOR RDR-1C TRANSMITTER-RECEIVER

SYMBOL NUMBER	TYPE OR PART NUMBER	FUNCTION
MODULATOR-TRANSMITTER SECTION		
V3001	582	High voltage rectifier
V3002	6268/AX9911	Switch
V3003	5727	Switch driver
V3004	QK456	Transmitter oscillator (magnetron)
V3005	6591	ATR
V3007	6624	TR
V3008	V221-H	Local oscillator
V3009	C678216-2	Suppressor, electrical surge (spark-gap)
RECEIVER-AFC SECTION		
V3101	5670	Cascode i-f amplifier
V3102	6136	I-f amp STC controlled
V3103	6136	I-f amp gain controlled
V3104	6136	I-f amp gain controlled
V3105	6136	I-f amp
V3106(A)	1/2 5751	Video amplifier

TABLE 1-2. TUBE COMPLEMENT FOR RDR-1C TRANSMITTER-RECEIVER (cont)

SYMBOL NUMBER	TYPE OR PART NUMBER	FUNCTION
RECEIVER-AFC SECTION (cont)		
V3106(B)	1/2 5751	Video amplifier
V3107	5751	Contour video amplifier
V3108	5687	Cathode follower video output
V3109(A)	1/2 5814	Clamp, contour level
V3109(B)	1/2 5814	STC voltage generator
V3110	5654	I-f amplifier
V3111	5751	Discriminator
V3112	6201/12AT7WA	Pulse amplifier
V3113	5726	Clamp, sweep generator
V3114	5725	Sweep generator
CRYSTAL DIODES MODULATOR-TRANSMITTER SECTION		
CR3001	C291642-2	Clipper
CR3002	C291642-2	Clipper
CR3003	C291625-2	Rectifier, KA voltage
CR3004	1N23C	Signal crystal (direct)
CR3005	1N23CR	Signal crystal (reverse)
CR3006	1N23CR	Afc crystal

SYMBOL NUMBER	TYPE OR PART NUMBER	FUNCTION	DESCRIPTION
RECEIVER-AFC SECTION			
CR3101	C221944-1	Detector	Germanium diode, 1N34A

TABLE 1-2. TUBE COMPLEMENT FOR RDR-1C TRANSMITTER-RECEIVER (cont)

SYMBOL NUMBER	TYPE OR PART NUMBER	FUNCTION	DESCRIPTION
		FUSES	
F3001	C221603-6502	Transformer T3001 protect	3 AG 5.0 amp slo-blo
F3002	C221603-5501	Transformer T3002 protect	3 AG 0.5 amp slo-blo
F3003	C221603-5751	Transformer T3003 protect	3 AG 0.75 amp slo-blo
F3004	C221603-5251	Transformer T3004 protect	3 AG 0.25 amp slo-blo

SUMMARY OF TYPES AND QUANTITIES

TYPE OR PART NUMBER	DESCRIPTION	TOTAL QUANTITY
VA221-H	Klystron	1
QK456	Magnetron	1
582	Half-wave rectifier	1
5654	Sharp cut-off r-f pentode (special 6AK5)	1
5670	High frequency twin triode (special 2C51)	1
5687	Medium-mu twin triode	1
5725	Dual control r-f pentode (special 6AS6)	1
5726	Twin diode (special 6AL5)	1
5727	Thyratron tetrode	1
5751	High-mu twin triode (special 12AX7)	3
5814	Medium-mu twin triode (special 12AU7)	1
6136	Sharp cut-off r-f pentode (special 6AU6)	4
6201/12AT7WA	High frequency twin triode	1
6268/AX9911	Hydrogen thyratron	1

TABLE 1-2. TUBE COMPLEMENT FOR RDR-1C TRANSMITTER-RECEIVER (cont)

SUMMARY OF TYPES AND QUANTITIES (cont)		
TYPE OR PART NUMBER	DESCRIPTION	TOTAL QUANTITY
6591	Gas ATR switch	1
6624	Gas TR switch	1
C678216-2	Spark gap	1
	TOTAL TUBES	22
CRYSTALS		
1N23C	Silicon diode	1
1N23CR	Silicon diode	2
C221944-1	Germanium diode	1
C291625-2	Selenium diode	1
C291642-2	Selenium diode	2
	TOTAL CRYSTALS	7

SECTION II
THEORY OF OPERATION

2-1. GENERAL.

This section covers the circuit theory of the circuits incorporated in the RDR-1C Transmitter-Receiver. Simplified partial schematics and block diagrams are included to help explain the various circuits and their interdependance. Complete schematic diagrams of the modulator-transmitter section and of the receiver-afc section are included in section IX of this handbook, figures 9-1 and 9-2.

All circuit symbol references in the 3000-3099 series refer to circuit components on the main chassis of the RDR-1C Transmitter-Receiver.

All circuit symbol references in the 3100-3199 series refer to circuit components on the receiver-afc subchassis.

2-2. CONTROL CIRCUITS.

a. GENERAL.--The RDR-1C Transmitter-Receiver is remotely controlled from a type CON-1A Control unit which is located convenient to the pilot or operator.

To follow the operation of the RDR-1C Transmitter-Receiver control circuits, see figure 2-1 which is a simplified schematic diagram of the control circuits in this unit. The sequential operation chart (figure 2-8 in instruction book IB-733) will also facilitate the analysis of the control circuits.

b. "STANDBY" ATTITUDE.--When switch S5001 on the CON-1A Control is placed in "ST'BY" position, 28 volts dc is applied to pin 1 of connector P3001 (2, figure 2-1) energizing stand-by relay K3002. This closes two a-c circuits. One a-c circuit supplies 115 volts 380-420 cps from pin 11 of P3001 (4) to the unit ventilating

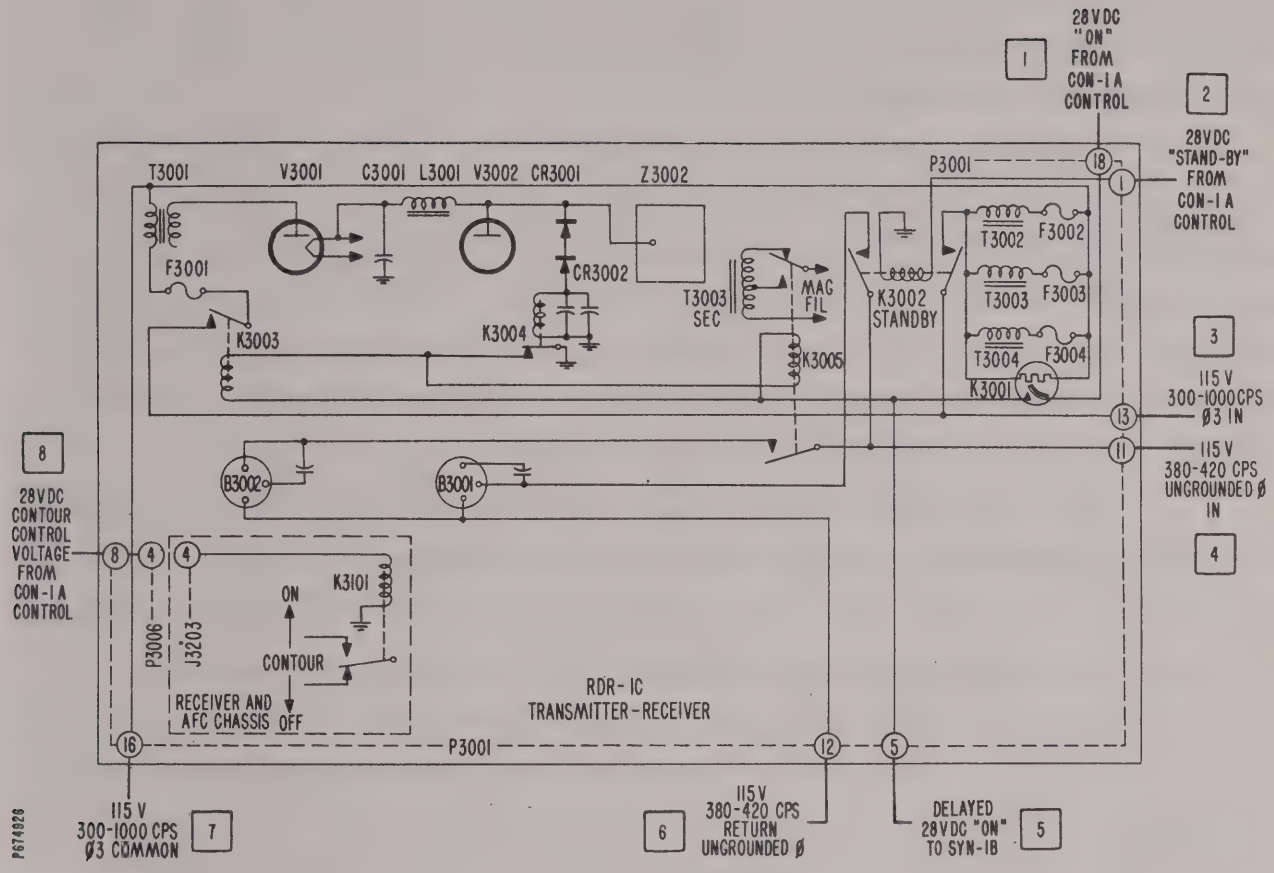


Figure 2-1. Control Circuits of RDR-1C Transmitter-Receiver, Simplified Schematic Diagram

fan B3001. The other a-c circuit supplies 115 volts 300-1000 cps from pin 13 of P3001 (3) to filament transformers T3002 and T3003; to power transformer T3004; and to the heater of time delay relay K3001. (See figure 2-1.)

Filament transformer T3002 (figure 2-2) has two secondary windings. One secondary supplies filament voltage to local-oscillator tube V3008 and to all but two tubes on the receiver-afc subchassis; the other secondary supplies filament voltage to clamp tube V3113 and sweep-generator tube V3114 on the receiver-afc subchassis.

Note that the filament supply to V3113 and V3114 is ungrounded. This is necessary since the filaments of V3113 and V3114 are biased 250 volts negative to maintain a low cathode-to-filament potential.

Filament transformer T3003 (figure 2-2) has two secondary windings. One secondary supplies filament voltage to switch tube V3002 and to switch driver tube V3003. The other secondary is tapped and supplies filament voltage to magnetron-oscillator tube V3004. Initially, the full winding is in use (system in "STANDBY") and supplies 6.3 volts to the magnetron filament. When the system is "ON", magnetron filament control relay operates to select a portion of the transformer secondary which then supplies 3.3 volts to the magnetron filament.

Power transformer T3004 (figure 2-2) has two secondary windings. One secondary supplies filament voltage to high-voltage rectifier tube V3001. The other secondary furnishes high voltage to the keep-alive voltage rectifier crystal CR3003.

The heater element of time delay relay K3001 (figure 2-1) is energized, by 115 volts ac, in both "STANDBY" and "ON" positions of switch S5001 on the CON-1A Control unit. The d-c contacts of relay K3001 close after approximately three minutes heating of the heater element. This closes the "ON" control circuit from the "ON" contact of the CON-1A Control switch S5001 to high-voltage relay K3003, magnetron filament control relay K3005, and pin 5 of plug P3001.

c. "ON" (OPERATING).--When switch S5001 on CON-1A Control is placed in the "ON" position, 28 volts dc is applied to pin 18 and to pin 1 of plug P3001 (1 and 2, figure 2-1). After the time delay introduced by relay K3001, 28 volts dc is applied to high-voltage relay K3003 and magnetron filament control relay K3005; in the event that switch S5001 has already been in "ST'BY" position for at least three minutes, relays K3003 and K3005 are energized instantly. The operation of relay K3003 applies 115 volts, 300-1000 cps, from pin 13 of plug P3001 (3) to the primary of high-voltage transformer T3001. The stepped-up voltage from the secondary of transformer T3001 is applied to high-voltage rectifier V3001. The rectified output of V3001 is the charging voltage for pulse-forming network Z3002.

The operation of relay K3005 applies 115 volts, 380-420 cps, from pin 11 of plug P3001 (4) to magnetron blower B3002, and lowers the filament voltage to the magnetron by utilizing a smaller portion of the magnetron filament supply secondary of transformer T3003. The magnetron blower operation and the reduction of magnetron filament voltage maintain magnetron tube V3004 at the proper operating temperature by minimizing the heating effect caused by electron bombardment of the cathode of the magnetron.

In addition to the above, 28 volts dc is made available at pin 5 of plug P3001 (5). This delayed control voltage energizes control relays in the SYN-1B Synchronizer-Amplifier-Power Supply placing it in full operation.

The primary ac from pins 11 and 13 of plug P3001 is returned to pins 12 and 16 (6 and 7), respectively.

Contour relay K3101 in the receiver chassis is energized when 28 volts dc is applied to pin 8 of plug P3001 (8). (See figure 2-1.) The action of contour relay K3001 is covered in paragraph 2-10c(2).

2-3. PROTECTIVE DEVICES.

a. TIME DELAY RELAY K3001.--Time delay relay K3001 is a thermal, time delay switch in series with the 28-volt d-c "ON" control circuit.

When "OFF-STBY-ON" switch S5001, on the CON-1A Control, is placed in the "STBY"or "ON" position, 115 volts ac is applied to the heater element of time delay relay K3001. The thermal element of relay K3001 causes the d-c contacts to close 180 ±20 seconds after the ac is applied to the heater, thus closing the d-c "ON" control circuit from pin 7 to pin 5 of relay K3001. The application of energizing voltage to high voltage relay K3003 and magnetron filament control relay K3005 in the RDR-1C Transmitter-Receiver, and to high voltage relay K4003 in the SYN-1B Synchronizer-Amplifier-Power Supply is, therefore, delayed for a time sufficient for all tubes to reach operating temperature before high voltage can be applied.

b. OVERLOAD RELAY K3004.--When gas bursts or arcing occur in the magnetron oscillator, causing momentary pulse-transformer impedance mismatching, a small negative (reverse) voltage may appear across pulse-forming network Z3002. Any small reverse voltage appearing across Z3002 will be bled off through clipper crystals CR3001 and CR3002, and through the overload relay coil to ground. (See figure 2-3.) Several consecutive mismatches may cause the reverse voltage to be appreciable, and, since this voltage is in series with the voltage from the charging source, a higher than normal voltage will be developed across the pulse-forming network. Unless protective measures are applied, this voltage would build to an amplitude sufficient to cause a breakdown of switch tube V3002.

To avoid this possibility, overload relay K3004 is designed to open when the current bleeding through its coil exceeds a fixed maximum, about 0.005 ampere. This allows the buildup of only a small reverse voltage before overload relay K3004 acts to open the d-c energizing circuit to high voltage relay K3003 and magnetron filament control relay K3005.

De-energizing high-voltage relay K3003 opens the a-c circuit to the primary of high-voltage transformer T3001, thus deactivating the high-voltage power supply as it is being overloaded.

De-energizing magnetron filament control relay K3005 restores full filament voltage to the magnetron, and at the same time opens the a-c circuit to magnetron blower B3002. With the blower off, and full filament voltage supplied, the magnetron is maintained at operating temperature just as though the system were in "STANDBY" attitude.

After a period of about one-half second, as determined by the time constant of the coil of relay K3004 and capacitor C3004, overload relay K3004 will cycle to its normally-closed position and re-establish all circuits opened by its original action.

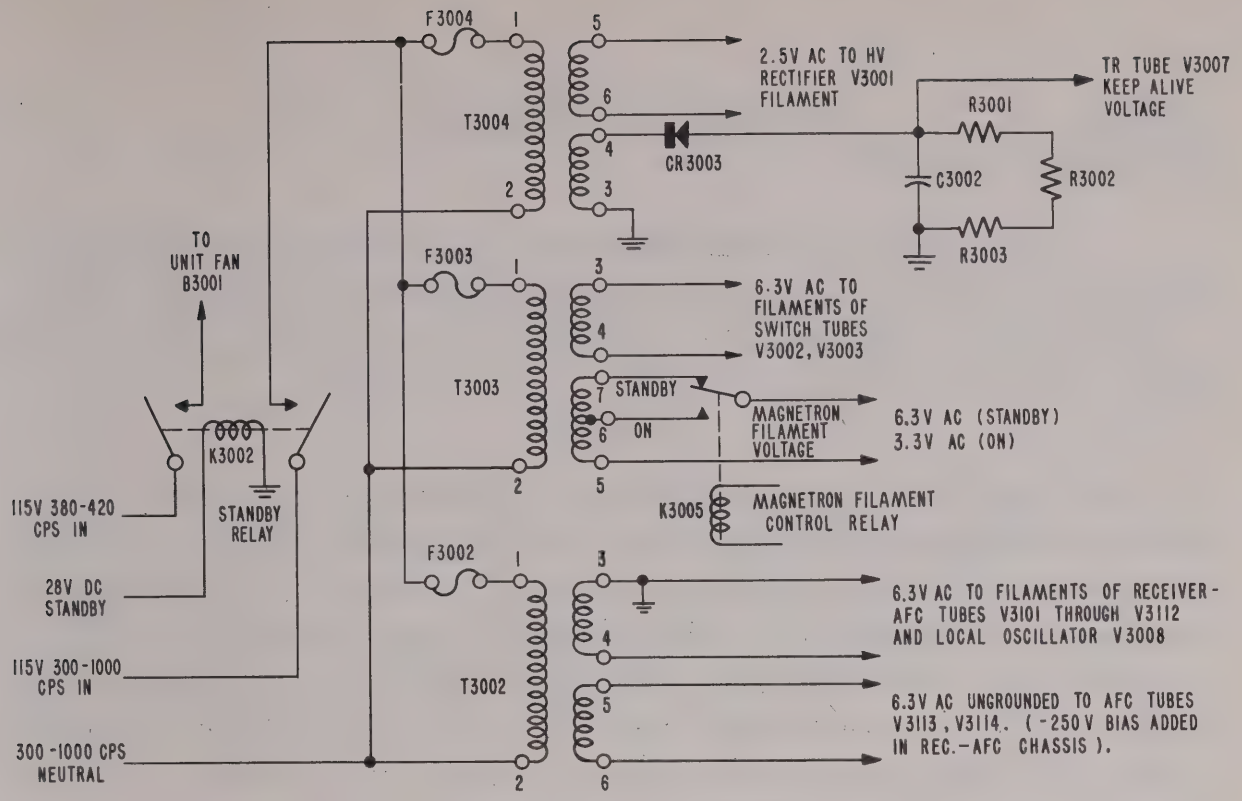


Figure 2-2. Low-Voltage and Keep-Alive Power Supplies, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

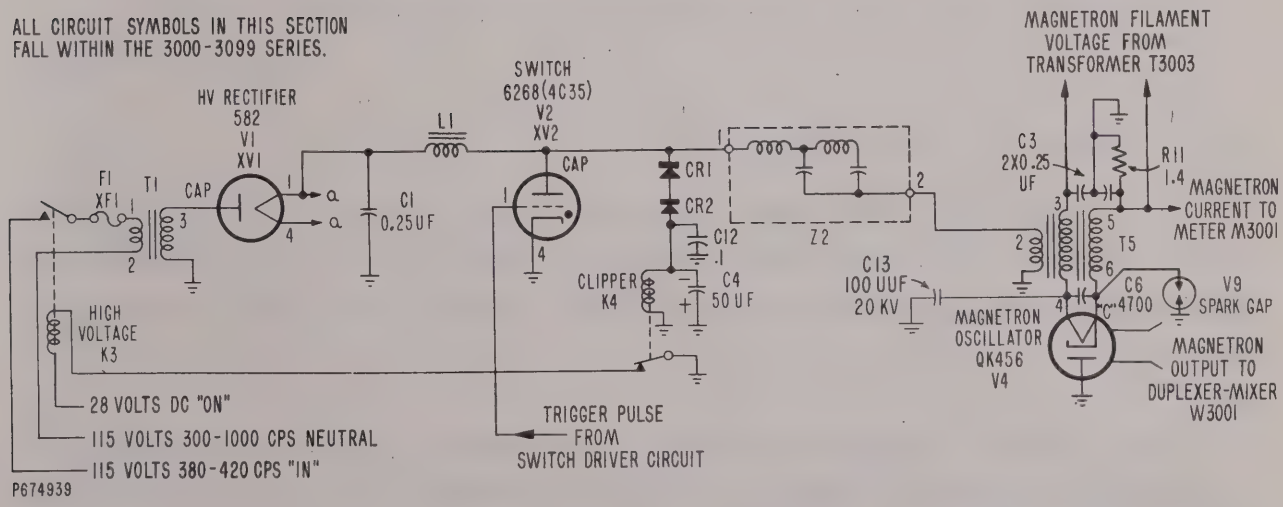


Figure 2-3. Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Including Transmitter High-Voltage Power Supply, Partial Schematic Diagram

If the cause of overload is relieved, relay K3004 will remain closed and full operation will be resumed. If the overload condition persists, relay K3004 will cycle at its normal rate, alternately making and breaking the circuits detailed above, until the cause of overload is removed.

c. SPARK GAP.--When switch tube V3002 (figure 2-3) is triggered during normal operation, a voltage is developed across the secondary windings of pulse transformer T3005. This voltage is normally in the order of 15 kv. If the magnetron oscillator V3002 fails to fire when pulsed, this voltage would increase to an amplitude which could damage pulse transformer T3005, magnetron oscillator V3002, or both. To prevent such damage, a sealed-in-glass spark gap (V3009, figure 2-3) is connected between the magnetron cathode connection "C" and ground. The spark gap is preset to arc over at approximately 19 kv, thus restricting the voltage buildup to a safe maximum.

d. FUSES.--Each of the four power transformers used in the transmitter-receiver is protected against overload by a type 3AG slo-blo fuse, as shown in figure 2-1. Blown fuses in this unit will not stop the operation of magnetron blower B3001 or unit ventilating fan B3002, since neither is in an internally fused circuit.

2-4. HIGH-VOLTAGE POWER SUPPLY.

a. GENERAL.--The high voltage power supply, shown in figure 2-3, consists of step-up transformer T3001, half-wave high vacuum rectifier V3001, and filter capacitor C3001. The output of this power supply is used to charge pulse-forming network Z3002.

b. INPUT.--An input of 115 volts, 300-1000 cps is applied to the primary of high voltage transformer T3001 through fuse F3001 and the closed contacts of energized

high voltage relay K3003. Transformer T3001 develops approximately 2600 volts rms across its secondary which is connected between the plate of high voltage rectifier V3001 and ground. Filament voltage for V3001 is supplied by the 2.5-volt secondary winding of transformer T3004. (See figure 2-2.)

c. OUTPUT.--High voltage rectifier V3001 develops a pulsating positive d-c voltage at its filament. Capacitor C3001 serves as a filter and charges to approximately 3500 volts dc, which is the approximate peak a-c input to V3001. This is the high voltage power supply output voltage available at the junction of filter capacitor C3001 and charging reactor L3001. (See figure 2-3.)

2-5. MODULATOR-TRANSMITTER SECTION.

a. GENERAL.--The modulator-transmitter comprises a charging circuit, a switch or discharge tube, a switch driver circuit, a pulse-forming or limiting network, a magnetron oscillator, and a pulse transformer. (See figures 2-3 and 2-5.) It is in this section of the unit that the high powered pulses of microwave energy are generated.

b. CHARGING CIRCUIT.--The capacitance and inductance of charging reactor L3001, PFN (pulse-forming network) Z3002, and the primary of pulse transformer T3005 form a d-c charging circuit which is series resonant at 200 cps. Essentially, all the inductance in the series resonant charging circuit may be attributed to charging reactor L3001, and all the capacitance to PFN Z3002. (See figure 2-3.)

When a capacitance is charged through an inductance from a constant voltage source, the voltage across the capacitance is in the form of a damped oscillation (figure 2-4,A). The first maximum is approximately equal to twice the supply voltage, if both the voltage across the capacitance and the current through the inductance are initially zero. The first maximum occurs at a time equal to one-half cycle of the resonant frequency of the charging circuit. Since the charging circuit is resonant at 200 cps, the first maximum occurs in one four-hundredth of a second.

When the supply voltage (3500 volts dc) is initially applied to the charging circuit, at the input of charging reactor L3001, a current is caused to flow through the reactor reaching a maximum at the same time the voltage across PFN Z3002 equals the input voltage (3500 volts dc). This occurs one eight-hundredth of a second after the initial voltage application. (See figure 2-4, C.)

Since the charge on PFN Z3002 is now equal to the supply voltage, current flow from the supply source ceases. The magnetic field built up by the initial current flow through charging reactor L3001 then collapses.

The collapsing field induces a current in charging reactor L3001 which is in the same direction as the initial current flow. This causes the charge on PFN Z3002 to increase to maximum, almost double the supply voltage.

The time required to develop maximum charge on PFN Z3002 is one four-hundredth of a second, as indicated in figure 2-4, A. If PFN Z3002 is discharged at this instant (B), maximum power is realized. This means that the prf (pulse repetition frequency) of the radar must be twice the resonant frequency of the charging circuit, or 400 pps (pulses per second).

c. DISCHARGE CIRCUIT.--Triggering of hydrogen thyratron switch tube V3002 provides a low impedance path for discharging PFN Z3002 through the primary of transformer T3005. (See figure 2-3.)

Triggering pulses of four microseconds each are applied to the grid of switch tube V3002, from the switch driver circuit (figure 2-3), at the rate of 400 pps. As shown in B, figure 2-4, PFN Z3002 is discharged each time it attains maximum charge. This occurs at twice the resonant frequency of the charging circuit. The trigger pulse and the peak charge on PFN Z3002 are closely synchronized, because, after the initial discharge of PFN Z3002, the next trigger pulse and the next peak charge occur simultaneously, 1/400 of a second later, and at 1/400-second intervals thereafter.

For each trigger pulse, switch tube V3002 ionizes (becomes conductive) and remains conductive during the time necessary to fully discharge PFN Z3002. Then V3002 quickly de-ionizes (cuts off) to restart the charging cycle.

The pulse appearing across the primary of pulse transformer T3005, resulting from the discharge of PFN Z3002, is of two-microsecond duration. This width is determined by the lumped constants of PFN Z3002.

Since the primary of pulse transformer T3005 is in series with PFN Z3002, the discharge voltage (7000 volts) is split between PFN Z3002 and the pulse transformer primary, 3500 volts appearing across each.

The apparent impedance (50 ohms) at the primary of pulse transformer T3005 and the impedance of PFN Z3002 are matched to give maximum power transfer, an essentially square wave, and to reduce reflections from the pulse transformer back into the pulse-forming network.

The high inductance of charging reactor L3001 isolates the high voltage power supply during discharge time.

2-6. MAGNETRON OSCILLATOR.

a. GENERAL.--Magnetron oscillator V3004 is a type QK456 fixed-tuned, multi-cavity magnetron, operating at a fixed frequency of 5400 ±30 megacycles. (See figure 2-3.)

b. INPUT.--The input to the magnetron is applied through the 4.46:1 step-up pulse transformer T3005. The design of the pulse transformer provides two parallel secondaries of identical electrical characteristics, one secondary in each leg of the magnetron filament circuit. This bifilar secondary winding maintains an equal and in-phase voltage on both sides of the filament and effectively isolates the high voltage pulse from the low voltage filament transformer T3003. Capacitors C3003 and C3006 compensate for slight electrical differences of high pulse voltages across the filament.

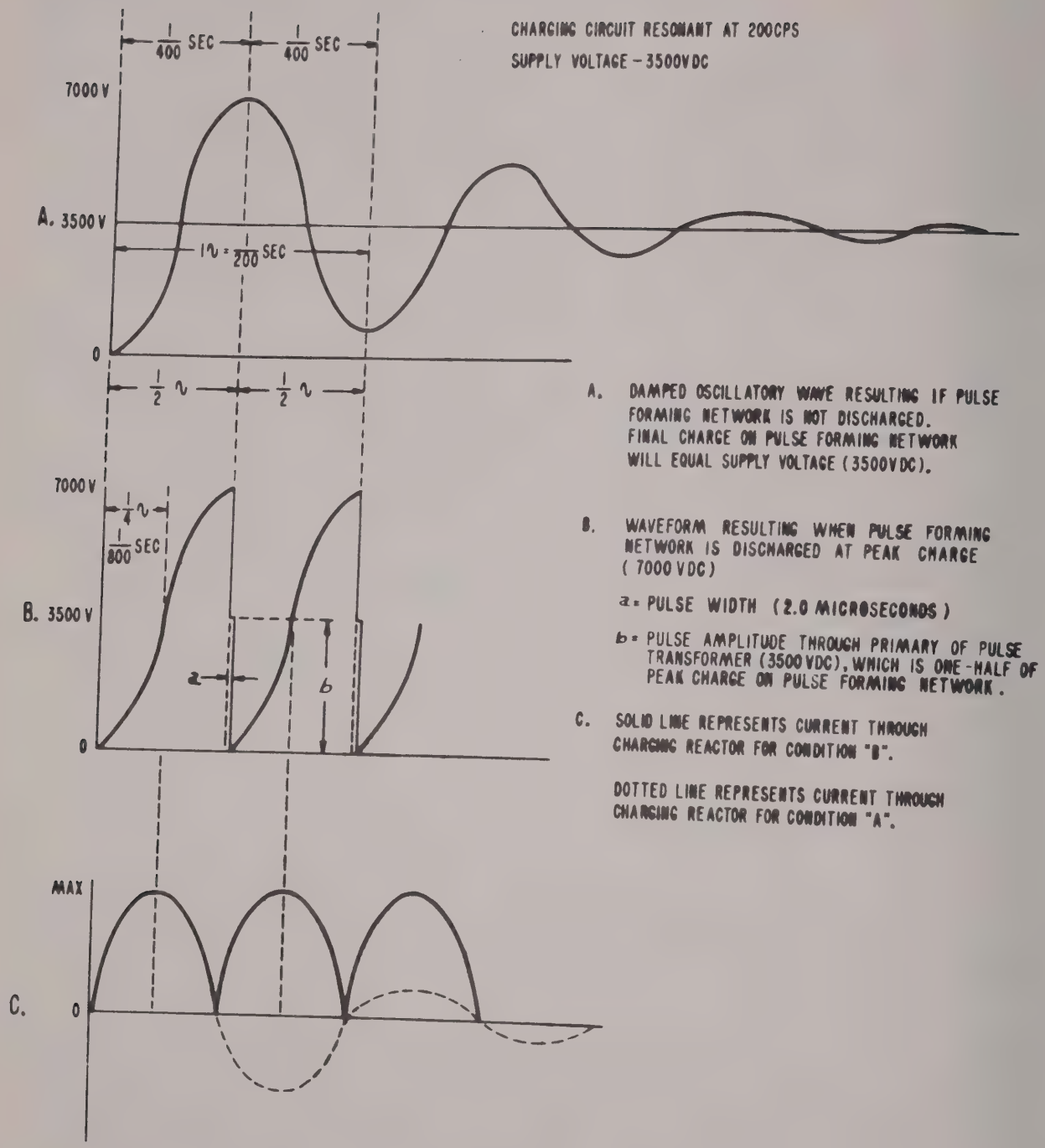

CHARGING CIRCUIT RESONANT AT 200CPS
SUPPLY VOLTAGE - 3500VDC
1/400 SEC
1/400 SEC
7000 V
A. 3500 V
0
1 ∿ = 1/200 SEC
1/2 ∿
1/2 ∿
7000 V
1/4 ∿
1/800 SEC
B. 3500 V
a
b
0
MAX
C.
0
A. DAMPED OSCILLATORY WAVE RESULTING IF PULSE FORMING NETWORK IS NOT DISCHARGED. FINAL CHARGE ON PULSE FORMING NETWORK WILL EQUAL SUPPLY VOLTAGE (3500VDC).
B. WAVEFORM RESULTING WHEN PULSE FORMING NETWORK IS DISCHARGED AT PEAK CHARGE (7000 VDC)
a = PULSE WIDTH (2.0 MICROSECONDS)
b = PULSE AMPLITUDE THROUGH PRIMARY OF PULSE TRANSFORMER (3500 VDC), WHICH IS ONE-HALF OF PEAK CHARGE ON PULSE FORMING NETWORK.
C. SOLID LINE REPRESENTS CURRENT THROUGH CHARGING REACTOR FOR CONDITION "B".
DOTTED LINE REPRESENTS CURRENT THROUGH CHARGING REACTOR FOR CONDITION "A".

Figure 2-4. Reference Waveforms, D-C Resonant Charging Circuit of RDR-1C Transmitter-Receiver

The output from the secondary of pulse transformer T3005 is a two-microsecond negative-going pulse approximately 15 kv in amplitude. This pulse is applied to the magnetron cathode, which shares a common connection with the filament. For each applied pulse, the magnetron fires to produce a two-microsecond pulse of microwave energy having a pulse power of 62.5-kw* peak minimum. This represents a peak pulse power output of 47 dbm (db above one milliwatt).

Since the duty cycle of the magnetron is 0.0008 (400 pps x 2 microseconds), then 62.5 kw x 0.0008 equals 50* watts which is the average power output of the magnetron.

The values noted "*" are absolute minimum values for satisfactory transmitter operation under adverse conditions of primary input power and signal attenuation through the duplexer waveguide assembly.

The d-c plate current of magnetron oscillator V3004 flows through its cathode circuit and meter shunt resistor R3011 to ground. Resistor R3011 is a wire-wound precision 1.4-ohm meter shunt and makes possible the monitoring of magnetron current by the use of meter M3001 and meter selector switch S3001. Magnetron current is negligible during quiescence, but the average or d-c current integrated over a period of pulsed operation will produce a 0.5 to 0.7 reading on panel meter M3001. The peak magnetron current during pulse periods ranges around 11 amperes.

c. OUTPUT.--The output of the magnetron is taken through a Mylar window across the waveguide output aperture which connects to the input of the duplexer-mixer assembly. The Mylar window provides protection for the magnetron output waveguide section against dirt and moisture.

The product of the combined operations of the high voltage power supply, the charging circuit, the pulse transformer, the magnetron oscillator, and the switch tube is a two-microsecond pulse of microwave energy, in the frequency range from 5370 to 5430 mc, having a nominal peak pulse amplitude of 100 kw, and a repetition frequency of 400 ±20 pps.

2-7. SWITCH DRIVER CIRCUIT.

a. GENERAL.--The switch driver circuit, figure 2-5, produces four-microsecond, high-amplitude pulses at the rate of 400 ±20 pps. These pulses are used to trigger switch tube V3002 in the modulator circuit.

b. CHARGING CIRCUIT.--The switch driver circuit utilizes d-c resistance charging to develop a 290-volt charge across PFN Z3001. PFN Z3001 is charged through charging resistor R3007 from the 300-volt d-c supply. Charging resistor R3007 isolates the supply voltage during discharge of PFN Z3001.

c. TIMING.--Timing is achieved by using 50/60-volt, 10-microsecond trigger pulses, generated in the SYN-1B Synchronizer-Amplifier-Power Supply at a prf of 400 ±20 pps. When the trigger pulse is applied to the grid of thyratron switch tube V3003, through blocking capacitor C3005 and isolating resistor R3008, the tube conducts, discharging PFN Z3001 through the primary of pulse transformer T3006. A four-microsecond positive pulse appears across the secondary of pulse transformer T3006 and the matching load resistor R3006, and is applied to the grid of switch tube V3002 through isolating resistor R3005.

A negative nine-volt bias for the driver circuit switch tube V3003 is obtained from the junction of divider resistors R3009 and R3010. This bias holds the tube below cutoff between trigger pulses and aids in quick de-ionization of V3003 after each discharge.

2-8. DUPLEXER-MIXER ASSEMBLY INCLUDING LOCAL OSCILLATOR.

a. GENERAL.--The duplexer-mixer assembly W3001, figure 2-6, is composed of sections of rectangular, C-band waveguide and includes a signal mixer, an afc mixer, a directional coupler, a TR switch, an ATR switch, a local oscillator, BNC fittings for signal take-off from crystals, and an N-type connector for directional coupler output.

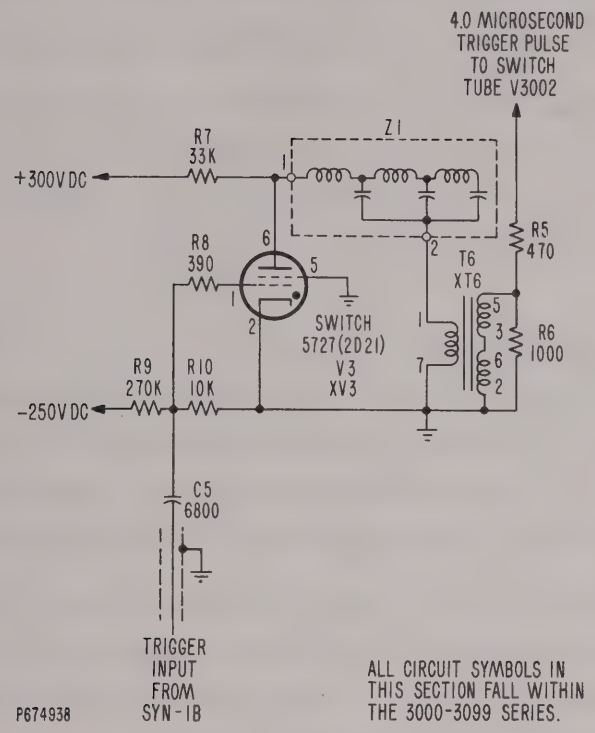


Figure 2-5. Switch Driver Circuit, Part of Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

The duplexer-mixer assembly performs the following functions:

Provides electronic switching to allow transmission and reception with a common antenna.

Provides a local oscillator frequency.

Provides a received signal if. for receiver input.

Provides an attenuated output from directional coupler to facilitate testing transmitter power and receiver sensitivity.

Provides magnetron-receiver isolation in the order of 20 db.

Blocks transmitted energy from signal mixer crystals.

Blocks received energy from entering transmitter section.

The duplexer-mixer assembly is contained in the transmitter-receiver package and connects directly to the output flange of the magnetron.

In operation, the pulse generated by the magnetron enters the r-f input flange of the duplexer. A sample of the transmitted pulse is picked off the narrow wall of the waveguide at a point near the input flange. This sample is directed to an afc mixer which is explained in paragraph 2-8d(2).

b. ATR TUBE.--As the pulse travels through the duplexer waveguide it reaches ATR tube V3005, a type 6591 broad-band gas-filled switching tube. This tube is mounted in the broad wall of the duplexer waveguide near the input flange and is considered to be in series with the waveguide. In its quiescent state, the ATR tube presents an open circuit (switch open) in the waveguide.

When the pulse of high power microwave energy reaches the ATR tube it strikes an r-f arc in the tube (switch closed). The result of thus closing the ATR "switch" is to complete the r-f circuit at its point of contact allowing the energy to proceed down the waveguide toward the output flange.

c. TR TUBE.--At approximately one-quarter wavelength further down the waveguide, the pulse encounters the junction of the main guide and the receiving branch. TR tube V3007, a type 6624 broad-band gas-filled switching tube, is mounted in the receiving branch one-half wavelength from the main guide junction. When the pulse reaches the TR tube it strikes an r-f arc in the tube (switch closed). The result of thus closing the TR "switch" is to short circuit the receiving branch at that point, but, because of the half-wave spacing, this short appears to the r-f pulse as if it were at the junction. There it completes the r-f circuit through the waveguide toward the output flange just as the ATR tube did. Consequently, the only path available to the pulse is the r-f circuit completed from magnetron to output flange.

The TR tube at the same time shorts out the receiving branch so that very little r-f energy reaches the signal crystals in the signal mixer, and crystal burnout is prevented in spite of the high power of the r-f pulse.

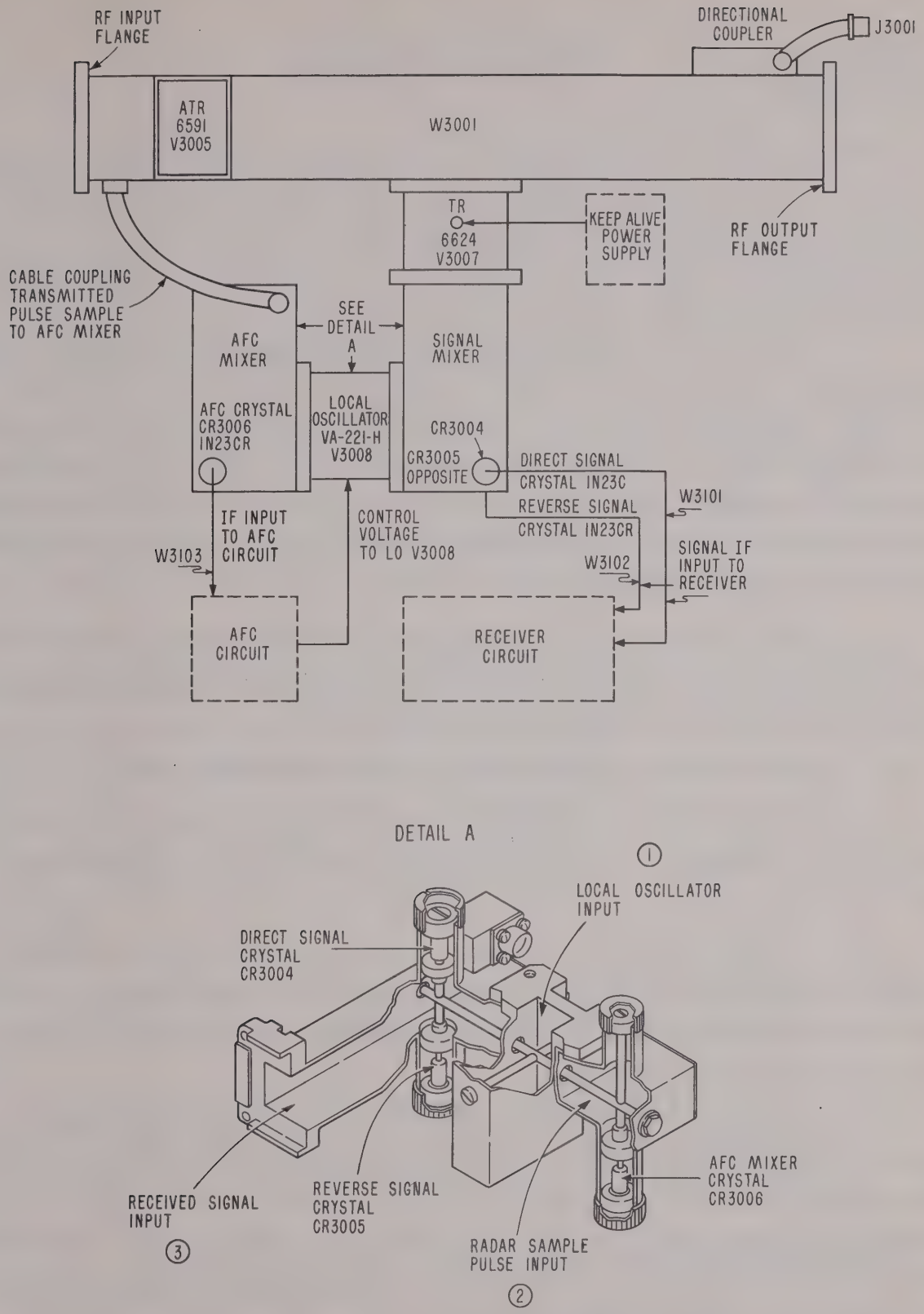


Figure 2-6. Duplexer-Mixer Waveguide Assembly W3001 Showing Connections to Receiver and Afc Circuits, Part of RDR-1C Transmitter-Receiver, Block Diagram and Cutaway Detail

When the magnetron is off, between transmitted pulses, the TR "switch" is open and the waveguide is not shorted or bypassed at that point. The TR tube is then an electronic gate, passing received r-f energy into the signal mixer section. The received energy lacks sufficient power to strike an arc in the TR tube.

The ATR tube, "open" between transmitter pulses, again appears as an open circuit in the guide and effectively disconnects the magnetron. Because the ATR tube is spaced one-quarter wavelength from the junction of the main guide and the receiving branch, the r-f open circuit at the ATR tube appears to the received signal as an r-f short circuit at the junction. This prevents received rf from continuing through the main guide toward the magnetron, thus preventing the dissipation of received energy in the transmitter.

The r-f circuit from the input flange, through the receiver branch, to the signal mixer is thus completed, and the received signal proceeds unimpeded to the signal mixer which is explained in paragraph 2-8d(1).

The foregoing cycle is repeated for each transmitted pulse.

TR tube V3007 is essentially a cavity resonator, tuned to the transmitting frequency, filled to a low pressure with gas, and fitted with an internal spark gap.

A small portion of the gas in the tube, just below the gap, is kept ionized by the application of a minus 700-volt d-c keep-alive voltage, making the firing of the tube by the transmitted pulse more nearly instantaneous, thereby extending the protective function of the tube.

The keep-alive voltage is provided by the keep-alive voltage supply shown in figure 2-2 and is applied to the TR tube through series resistor R3004. This resistor allows for the presence of the full keep-alive potential on the TR tube between transmitted pulses. During transmission, when the TR tube is completely ionized, resistor R3004 acts as a limiting resistor restricting current flow from the keep-alive power supply to a safe, low level.

d. MIXER SECTION.--The mixer section (figure 2-6) consists of a signal mixer, an afc mixer, and an l.o. (local oscillator) feed section.

Energy from the local oscillator is coupled by waveguide into a coaxial-to-waveguide cross-bar transition (l.o. feed). (See 1, of detail A.) Here the l.o. energy is split equally and fed by two coaxial lines to two equivalent magic tee hybrid mixers constructed of coaxial and waveguide in combination.

Received signal energy is fed into the signal mixer section (3 of detail A) and a sample of the transmitted pulse is fed into the afc mixer section (2 of detail A). Therefore, the crystals in the signal mixer section are driven by the l.o. and received signals to produce a signal if.; the crystal in the afc mixer section is driven by the l.o. and the sample of the transmitted pulse to produce an afc if.

(1) SIGNAL MIXER.--The signal mixer section contains a direct signal crystal CR3004 (type 1N23C) and a reverse signal crystal CR3005 (type 1N23CR). Both crystals are driven equally but 180 degrees out of phase with each other, by the received signal. Since one direct crystal and one reverse crystal are used in combination, the signal if. produced by each crystal will be in phase and is, therefore, additive. Detected local-oscillator noise components will be of opposite polarity, effectively cancelling each other to practically eliminate l.o. noise components in the signal if.

The signal if. taken from crystals CR3004 and CR3005 is fed to the input stage of the receiver through cables W3101 and W3102, respectively.

(2) AFC MIXER.--The afc mixer section contains a single, reverse crystal CR3006 (type 1N23CR). Since the afc mixer is operated single-ended, a coaxial termination is mounted on the opposite side of the cross-bar transition.

The afc if. taken from crystal CR3006 is fed to the input stage of the afc circuit through cable W3103.

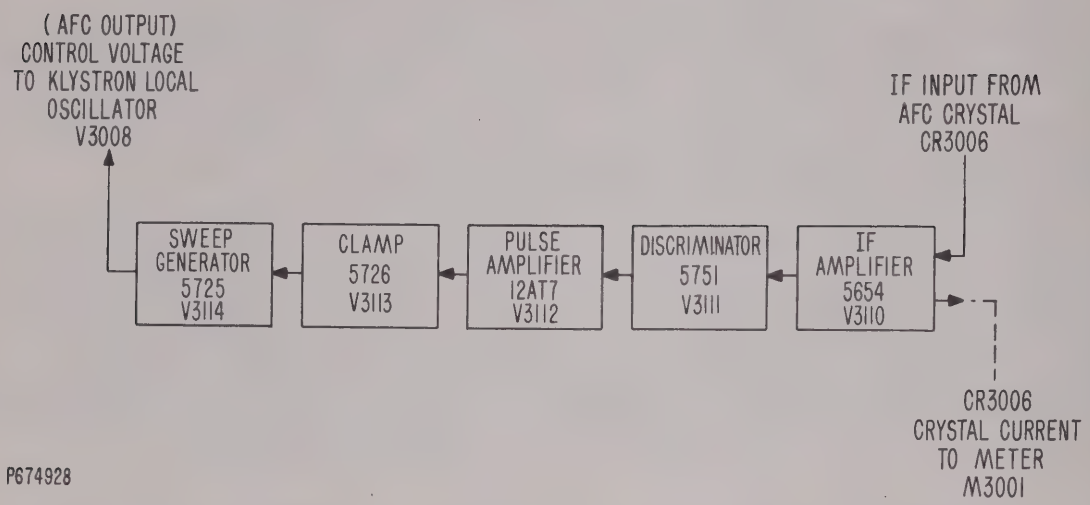


Figure 2-7. Afc Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Block Diagram

e. LOCAL OSCILLATOR.--Local oscillator tube V3008 is a type VA-221-H klystron, operating at 30 mc below the magnetron output frequency of 5400 ±30 mc. The cathode is grounded and the shell voltage is approximately +300 volts dc. The l.o. frequency is controlled over a narrow range by the reflector voltage which varies between approximately -140 and -180 volts dc as determined by the afc circuit.

L.o. tube V3008 is, initially, manually tuned to lock in at 30 mc below the magnetron operating frequency and is held at this frequency difference by the action of the afc circuit which is discussed in paragraph 2-9.

f. DIRECTIONAL COUPLER.--The directional coupler is an auxiliary section of waveguide coupled to the main waveguide by two holes spaced a quarter wavelength apart. This coupling affords cancellation of energy flowing to one end of the coupler and reinforcement of energy flowing to the opposite end. The directional coupler is connected by coaxial cable to test jack J3001 on the front panel of the transmitter-receiver unit. This provides a convenient test point for transmitter

output and receiver sensitivity. The combined attenuation of the directional coupler and the coaxial cable to test jack J3001 is stamped on the main transmitter-receiver chassis frame. (See figure 6-6.)

2-9. AFC CIRCUIT.

a. GENERAL.--The afc circuit is included on a removable subchassis with the receiver circuit. The afc section shown in block diagram, figure 2-7, consists of an input i-f amplifier, a discriminator, a pulse amplifier, a sweep clamp, and a sweep generator which doubles as a d-c amplifier.

The afc circuit functions to maintain the local oscillator frequency 30 megacycles below the magnetron oscillator frequency so that a 30-megacycle i-f signal will be developed from mixing the local oscillator and "echo" signals. The afc circuit is a closed loop in which a change in the difference frequency (30 megacycles), applied to the afc input, causes an output which changes the local oscillator frequency so that the correct difference frequency is again developed.

The 30-megacycle i-f signal from the afc mixer of the duplexer is amplified by i-f amplifier V3110 and applied to a Weiss discriminator, V3111. Depending on whether the i-f signal is exactly at 30 megacycles, or is above or below this frequency, the discriminator and amplifier output will be a voltage pulse near zero, of positive or negative polarity. The pulse is amplified by pulse amplifier V3112 and applied to the circuits of clamp tube V3113 and phantastron sweep generator V3114. The phantastron sweep generator d-c amplifier output, by controlling the negative reflector voltage applied to the klystron oscillator, controls the l.o. frequency over the desired range.

b. INPUT.--The afc input (figure 2-8) consists of a tuned i-f amplifier circuit and an afc crystal current filter circuit. Capacitors C3140, C3143, C3157A, resistor R3154, and inductor L3122 comprise the crystal current filter circuit, the

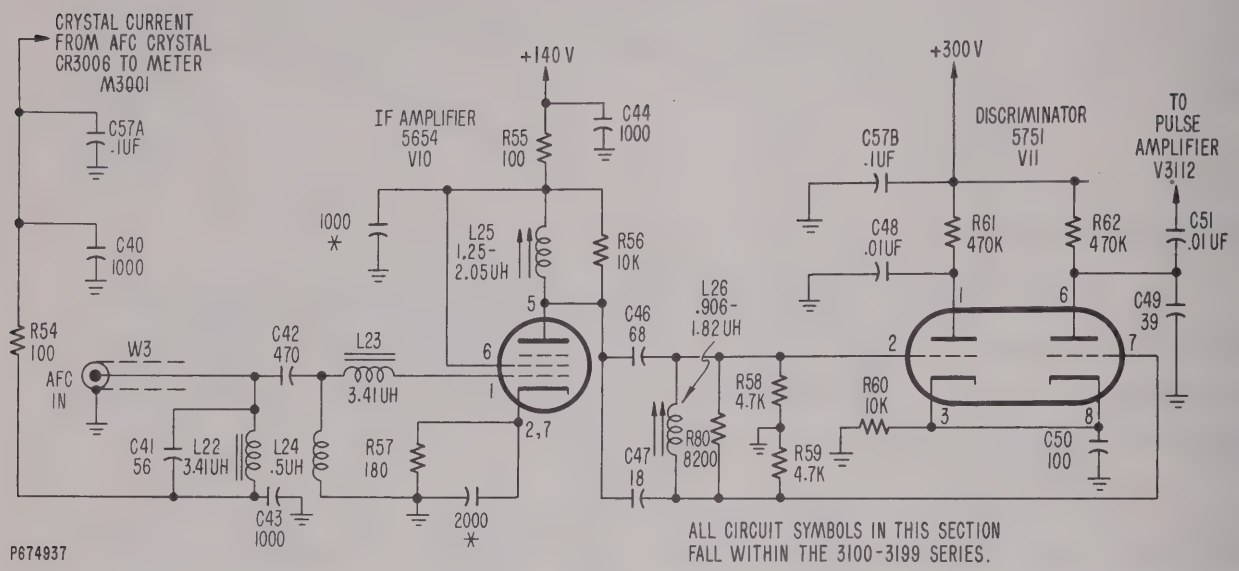


Figure 2-8. Input Amplifier and Discriminator Section of Afc Circuit, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

output of which is used to monitor the functioning of the afc mixer circuit. The input circuit of i-f amplifier V3110 is broadly tuned at 30 mc by capacitor C3141 and inductors L3123 and L3124. Capacitor C3142 blocks afc crystal current to the grid of V3110. The output circuit of i-f amplifier V3110 is tuned by inductor L3125 and is broad-banded by resistor R3156. The output from i-f amplifier V3110 is coupled to the discriminator circuit through capacitors C3146 and C3147.

c. DISCRIMINATOR.--The circuit of discriminator V3111 (figure 2-8) operates as a Weiss discriminator and as a limiter, in which the polarity of the output pulse depends on the frequency relationship of the input signal to the discriminator cross-over frequency (30.2 megacycles). The discriminator input circuit consists of capacitors C3146 and C3147, which are of different values, and tuning inductor L3126. The input circuit of discriminator tube V3111 consists of the two equal

grid-to-ground resistors R3158 and R3159 and the input capacitances of the two sections of V3111. The values of C3146, C3147, and L3126 are such as to develop equal voltages across the tube input capacitances and grid resistors R3158 and R3159 when the input signal is 30.2 megacycles. Because of the difference in the values of capacitors C3146 and C3147, input signals above 30.2 mc see an impedance at input leg C3146-L3126 which is greater than that at input leg C3147-L3126, so that the voltage at the grid, pin 2, of the first section of V3111 is greater than that at the grid, pin 7, of the second section. Conversely, input leg C3147-L3126 presents an impedance to input signals below 30.2 mc which is greater than that at input leg C3146-L3126, so that the voltage at the grid, pin 7, of the second section of V3111 is greater than that at the grid, pin 2, of the first section.

Discriminator tube V3111 is essentially an infinite impedance detector and differential amplifier.

The first section (pins 1, 2, 3) of V3111 is distinguished as an infinite impedance detector by the fact that the detected signal output appears across cathode resistor R3160.

Under "no-signal" conditions, cathode resistor R3160 builds up a bias which keeps the grid potential near cutoff. It cannot reach cutoff because this would stop the plate current flow which produces the bias. Since resistor R3160 is common to both cathodes, the bias on both grids of V3111 is equal under "no-signal" conditions.

Because of the proximity of cutoff, the positive half-cycles of the signal applied to the first grid, pin 2, are passed and negative half-cycles are cut off.

Positive half-cycles of the signal applied to both grids tend to buck each other since a positive signal on the first grid, pin 2, causes conduction in the first section of the tube and an increase in the voltage drop across common cathode resistor R3160; this causes the bias on the second grid, pin 7, to increase, and, depending on the relative amplitude of the signals, cancels, or partially cancels the positive

signal on the second grid, pin 7. Thus, a greater positive voltage swing at the first grid, pin 2, than at the second grid, pin 7, (condition of frequency of input signal above 30.2 megacycles) causes a bias to develop on common cathode resistor R3160 that overrides the weaker positive voltage on the second grid, pin 7, and results in a positive pulse at the plate, pin 6.

A greater positive voltage swing at the second grid, pin 7, than at the first grid, pin 2, (condition of frequency of input signal below 30.2 megacycles) results in a net positive signal on the second grid, pin 7, causing a negative pulse to be developed at the plate, pin 6.

The first plate, pin 1, is practically at a-c ground potential through plate bypass capacitor C3148. Section B of capacitor C3158 acts as a filter in the B-plus bus.

The pulse output of discriminator V3111 is applied across integration capacitor C3149 to ground and through capacitor C3151 to the grids of the pulse amplifier V3112. Capacitor C3149 is a pulse stretcher component; the stretched pulse is used in the following circuit to maintain a steady average charge on capacitor-resistor network C3152-R3166.

d. PULSE AMPLIFIER.--Pulse amplifier V3112 (figure 2-9) employs the two triode sections of a type 6201/12AT7WA twin-triode in parallel. V3112, through the normal phase inversion property of an amplifier, provides output pulses of the correct polarity to operate the following negative clamp circuit. Degeneration is provided by the unbypassed cathode resistor R3165 to stabilize the amplifier gain. The output is coupled to clamp tube V3113 by coupling capacitor C3152.

e. CLAMP CIRCUIT.--Parallel-connected twin-diode tube V3113, capacitor C3152, and resistor R3166 operate in a negative clamping circuit (figure 2-9) which functions to provide a variable negative bias voltage for the control grid of tube V3114.

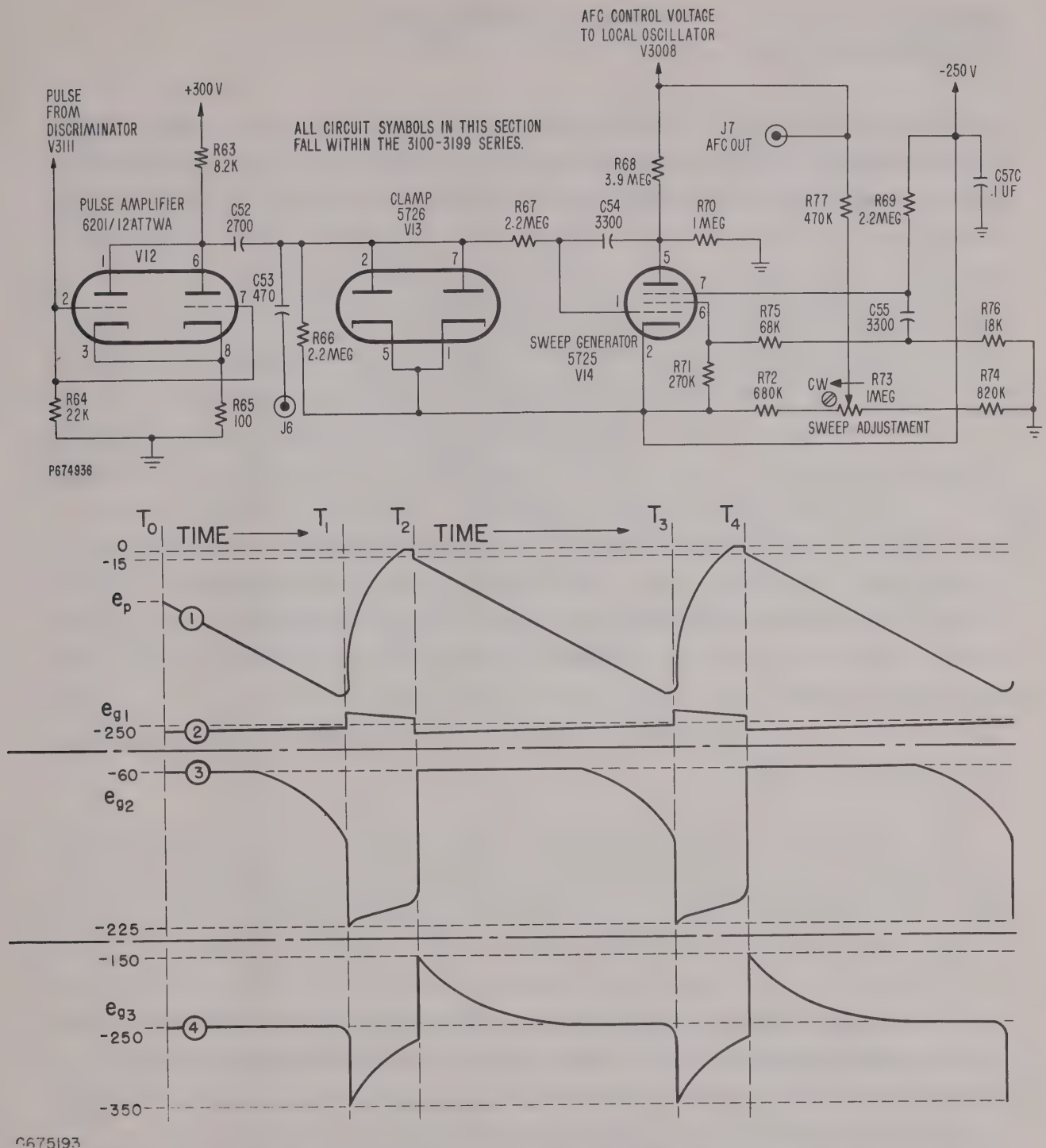


Figure 2-9. Pulse Amplifier, Clamp, and Sweep-Generator Sections of Afc Circuit, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram and Reference Waveforms

At i-f frequencies below 30 megacycles, positive pulses appear at the plate of V3112 and are coupled by capacitor C3152 to the plates of clamp tube V3113. During each pulse the diode conducts and capacitor C3152 is charged to almost full pulse voltage; the charge on the clamp tube plate side of capacitor C3152 is negative. After the pulse passes, the clamp tube is nonconducting because of the negative voltage developed across it by the discharge of capacitor C3152 through resistor R3166. Capacitor C3152 does not discharge completely since the discharge time constant of capacitor C3152 and resistor R3166 is long compared to the interval between pulses. After a few cycles, the charge on capacitor C3152 reaches an equilibrium and the average negative voltage developed by the clamp circuit is directly proportional to the amplitude of the positive pulses. At i-f frequencies above 30.2 megacycles, the clamping circuit receives negative pulses from the plate of V3112, and the average voltage developed across the clamp tube is essentially zero. It is to be noted that the discriminator circuit and pulse amplifier circuit preceding the clamp circuit is designed to develop a positive pulse output from the pulse amplifier when the i-f frequency is at the corre value (30 megacycles). This is necessary in order that the clamp circuit can develop a negative bias to stop the phantastron rundown, and to maintain the normal phantastron circuit as an amplifier.

f. SWEEP GENERATOR CIRCUIT.--The sweep generator tube V3114 and its associated circuitry (figure 2-9) has two operating modes. In one mode it functions as a d-c amplifier, in the other as a free-running sawtooth sweep-voltage generator.

Functioning as a sawtooth sweep-voltage generator, V3114 produces a down-sweeping negative sawtooth voltage. A portion of V3114 output, taken from the junction of divider resistors R3168-R3177, is applied to the repeller anode of local-oscillator tube V3008 and sweeps the local-oscillator frequency over a 40- to 50-megacycle hunting range. The local-oscillator frequency is swept upward, from some lower frequency, to a frequency just 30 megacycles below the operating

frequency of magnetron oscillator V3004, at which time a control voltage will be developed across clamp tube V3113, as previously described. This control voltage, applied to control grid G_1 of sweep-generator tube V3114, stops the sweep rundown of V3114 and converts V3114 into a d-c amplifier.

Functioning as a d-c amplifier, V3114 amplifies the control voltage applied to its grid G_1. Its output varies in phase inversely as the input voltage. The resulting output voltage causes the local-oscillator frequency to correct for changes (up to approximately ±15 megacycles) in magnetron frequency. Thus, the afc circuit maintains a 30-megacycle intermediate frequency.

For large changes in, or loss of, magnetron frequency, causing the if. to shift appreciably, or disappear entirely, the output of discriminator tube V3111 drops; the control voltage on grid G_1 of V3114 disappears; control of V3114 is lost and V3114 is immediately converted back to a sawtooth sweep-generator. This starts another hunting cycle and the process is repeated.

To follow the description of sweep-generator tube V3114 operation, refer to the schematic and waveshape diagrams in figure 2-9.

The basis of operation of sweep-generator tube V3114 is the negative transconductance that exists between the suppressor grid, pin 7, and screen grid, pin 6, of the pentode. As used in the afc control circuit, it is a free-running sawtooth oscillator whose plate voltage sweeps slowly from just below plate supply potential to a point not far from cathode potential, after which it snaps back rapidly and starts the downsweep again. The downward sweep part of the cycle is used as the hunting sweep and is applied to the repeller anode of the local oscillator. Thus, the local oscillator is caused to sweep from low to high frequency, once for each cycle of the applied negative-going sweep voltage.

If, during the downsweep, the grid-return resistor is tied to a point suitably negative with respect to the cathode, the sweep action will be arrested and the tube will then act as a normal d-c amplifier. Such a negative bias, supplied

by clamp tube V3113 when it receives control information from discriminator tube V3111 (figure 2-8) through pulse amplifier tube V3112 (figure 2-9), is the basis of afc locking.

The sequence of sweep events which takes place in this circuit, starting at the beginning of a downsweep, is as follows:

Assuming the instantaneous plate voltage of V3114 is some 200 volts positive with respect to the cathode (curve 1 of figure 2-9, at time T_o), then, since at time T_o the cathode current is small, control grid G_1 must be nearly at cutoff, about 10 volts below cathode potential (curve 2, at time T_o). The relatively heavy bias on grid G_1 is developed at the start of each downsweep of plate voltage as described later. (See curve 2, at time T_2.)

The division of cathode current between plate and screen is in the ratio of about 4:1. The resulting screen current is very small. At this time the potential on grid G_2 (approximately 190 volts above cathode potential) is determined by voltage dividing resistors R3171, R3175, and R3176. Suppressor grid G_3 will be at cathode potential and practically all of the small cathode current will be flowing to the plate.

At the beginning of the plate voltage downsweep the local oscillator will be so far off tune that no control information appears at the output of pulse amplifier tube V3112. The clamp tube V3113 plays no part at this time since its plate will be at approximately minus five volts with respect to its cathode. This is due to the voltage division between resistors R3166-R3167. Because the control grid G_1, of V3114, is 10 volts negative, a 10-volt drop appears across resistors R3166-R3167 and a current of approximately 2.5 microamperes flows to discharge capacitor C3154. Capacitor C3154, however, does not discharge at the RC rate indicated by the combination of capacitor C3154 and resistors R3166-R3167, for, as the grid G_1 rises the plate voltage approaches cathode potential "A" times as fast (where "A" is the gain of the stage) and since the drop in plate voltage is coupled back to grid

G_1, through capacitor C3154, there is an apparent input capacitance much greater than the actual feedback capacitance of C3154. This capacitance amplification makes possible very slow sweeps with small capacitors. It is a manifestation of the well known Miller effect.

The downward sweep of the plate voltage and the rise of grid G_1 voltage is shown between times T_o and T_1 on the waveshape diagram of figure 2-9. In practice, the grid G_1 voltage swings from about -10 volts toward zero as the plate covers its sweep. The sweep is relatively linear and the sweep rate is nearly independent of tube characteristics.

During the plate voltage rundown period (time T_o to T_1) the voltage drop across screen resistor R3171 is high, because most of the cathode current reaches the plate causing a minimum screen current through screen resistors R3175 and R3176. As the plate voltage approaches cathode potential, an increasing fraction of the increasing cathode current is diverted to the screen grid G_2 whose potential, therefore, starts to fall. Because of capacitor C3155, this fall in screen potential is coupled over to the suppressor grid G_3. Soon, the process becomes regenerative, as shown at time T_1. As suppressor grid G_3 is carried below cathode potential, it diverts current from plate to screen, causing plate voltage to rise and screen voltage to fall further. The rise in plate voltage is coupled through capacitor C3154 to grid G_1, causing a sharp rise in grid G_1 voltage (curve 2, at time T_1), thus causing an increase in cathode current most of which now flows to the screen grid G_2, further accelerating the process described above. The entire transition actually takes place in a few microseconds.

When the control grid G_1 voltage has been carried by the plate to a slightly positive voltage (curve 2, at time T_1), grid current will flow, preventing further increase in grid G_1 voltage. At this instant the cathode current is large and all of it flows to the screen, the plate being cut off by suppressor grid G_3. Consequently the screen grid G_2 potential is close to cathode potential, suppressor grid G_3 potential is far below cathode potential, and plate voltage is just slightly above its value at the end of the slow downsweep. (See all curves at time T_1.)

During the next period, between times T_1 and T_2, capacitor C3154 is charged, with a time constant represented by plate resistor R3170 and capacitor C3154, toward plate supply voltage. Meanwhile, the charge on capacitor C3155 leaks off through resistor R3169, so that the suppressor grid G_3 voltage approaches cathode potential with a time constant represented by resistor R3169 and capacitor C3155. Presently, the suppressor grid G_3 voltage comes close enough to cathode potential to allow some of the cathode current to reach the plate, which by this time is practically at plate supply voltage. This flow of plate current, by causing the plate voltage to drop (curve 1, at time T_2), starts the second downward sweep (between times T_2 and T_3) as follows:

The sharp downward trend of plate voltage (at time T_2), being transmitted by capacitor C3154 to control grid G_1, causes a sharp drop in control grid G_1 voltage sending it some 10 volts below cathode potential; a decrease in cathode current and, therefore, a decrease in screen current. The resultant rise in screen grid G_2 voltage, because of capacitor C3155, causes a similar rise in suppressor grid G_3 voltage, which, in turn, allows more current to reach the plate. Thus, the original effect is accelerated by the increased drop in plate voltage and by the decreased screen current.

Again there is a fast transition which stops only when the control grid G_1 voltage has been carried so far negative that only a little cathode current flows, an amount consistent with the plate current flow necessary to maintain plate voltage some 10 volts below plate supply voltage. At this point, the slow downsweep repeats, starting the new cycle at time T_4. This sawtooth downsweep, then, will recur until a control signal is developed by discriminator tube V3111, indicating that a 30-megacycle if. has been achieved.

The control signal, or control voltage, used to stop the sweep-generator rundown at the correct level has been described in preceding paragraphs. When such a control voltage exists, the bias on control grid G_1 of V3114 overcomes the

negative feedback coupled from the plate by capacitor C3154, stopping the plate run-down and converting the tube from a sweep generator to a d-c amplifier.

In summary, if the i-f signal, causing the bias voltage, should exceed 30 megacycles, indicating that the local-oscillator frequency is too low, the bias on (d-c amplifier) tube V3114 swings less negative and its plate voltage swings downward. This forces the local oscillator frequency to go higher, thus shifting the if. down toward the desired 30 megacycles. An if. below 30 megacycles would cause the bias on grid G_1 of V3114 to go more negative, the plate voltage to rise, thus shifting the local-oscillator frequency downward to again achieve a 30-megacycle if.

g. AFC SWEEP ADJUSTMENT.--Sweep-adjusting potentiometer R3173 is used to set the average level of the local-oscillator control voltage so that the sawtooth sweep voltage output of V3114 sweeps symmetrically across the desired klystron power mode. This insures that the afc lock-in range will be a maximum. When such adjustment is made, the local oscillator will remain locked in and will follow reasonable variations in magnetron output frequency to maintain a 30-megacycle if.

2-10. RECEIVER.

a. GENERAL.--The normal functions of a superheterodyne receiver are performed in two different sections of the RDR-1C unit. The r-f signal acceptance, local oscillator, and mixing functions are performed in the duplexer, which is described in paragraph 2-8; i-f amplification, video detection, and video amplification are performed at the receiver-afc chassis as described in this paragraph.

The receiver may be considered as having two major sections, an i-f amplifier section, and a video-contour amplifier section. (See figure 2-10.)

The receiver is supplied with signals at an intermediate frequency of 30 mc from two crystal detectors in the signal mixer section of the duplexer-mixer

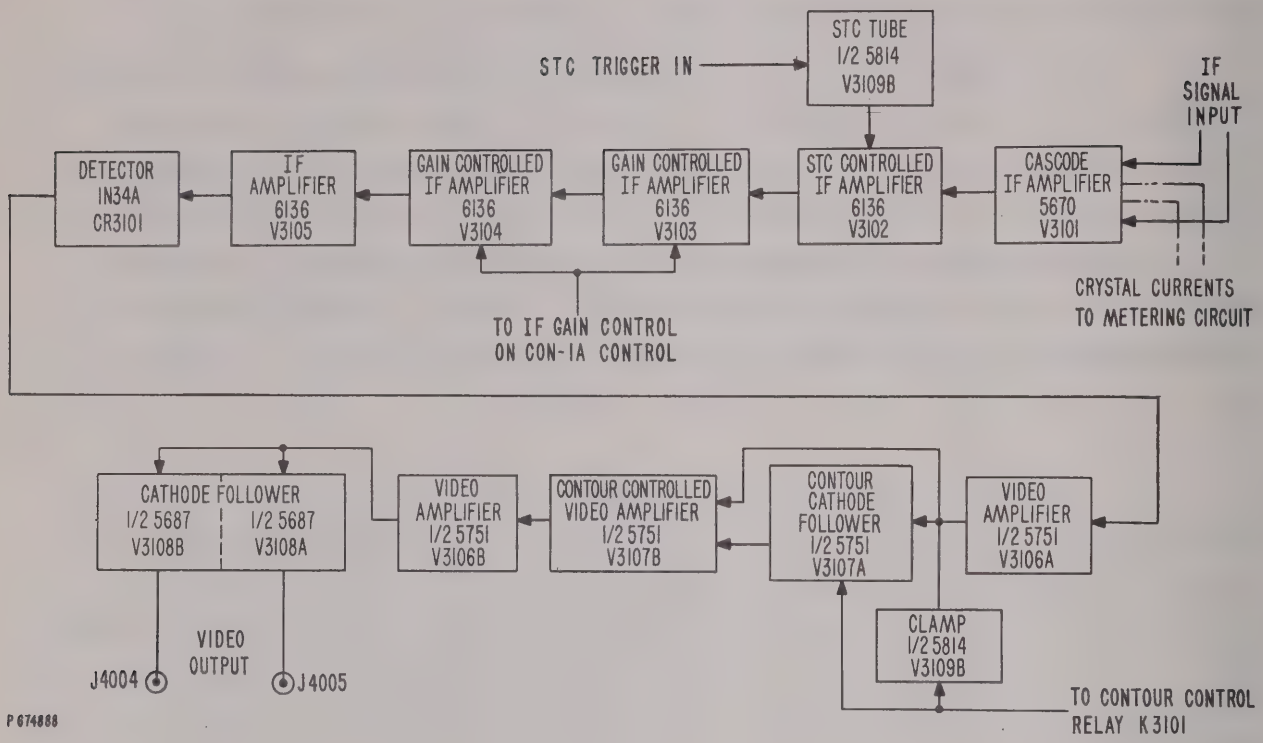


Figure 2-10. Receiver Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Block Diagram

waveguide assembly W3001. The action of the signal mixer is such that the parallel signal inputs from signal crystals CR3004-CR3005 are in phase, whereas the noise output of the local oscillator appears out of phase, thus providing an improved signal-to-noise ratio which results in greater receiver sensitivity.

Remote control of receiver gain is possible through the use of a manual i-f gain control circuit incorporated with the system equipment.

An STC (sensitivity-time-control) circuit in the receiver automatically reduces receiver gain immediately after each transmitted pulse, but restores it exponentially, to a level determined by the setting of the manual gain controls.

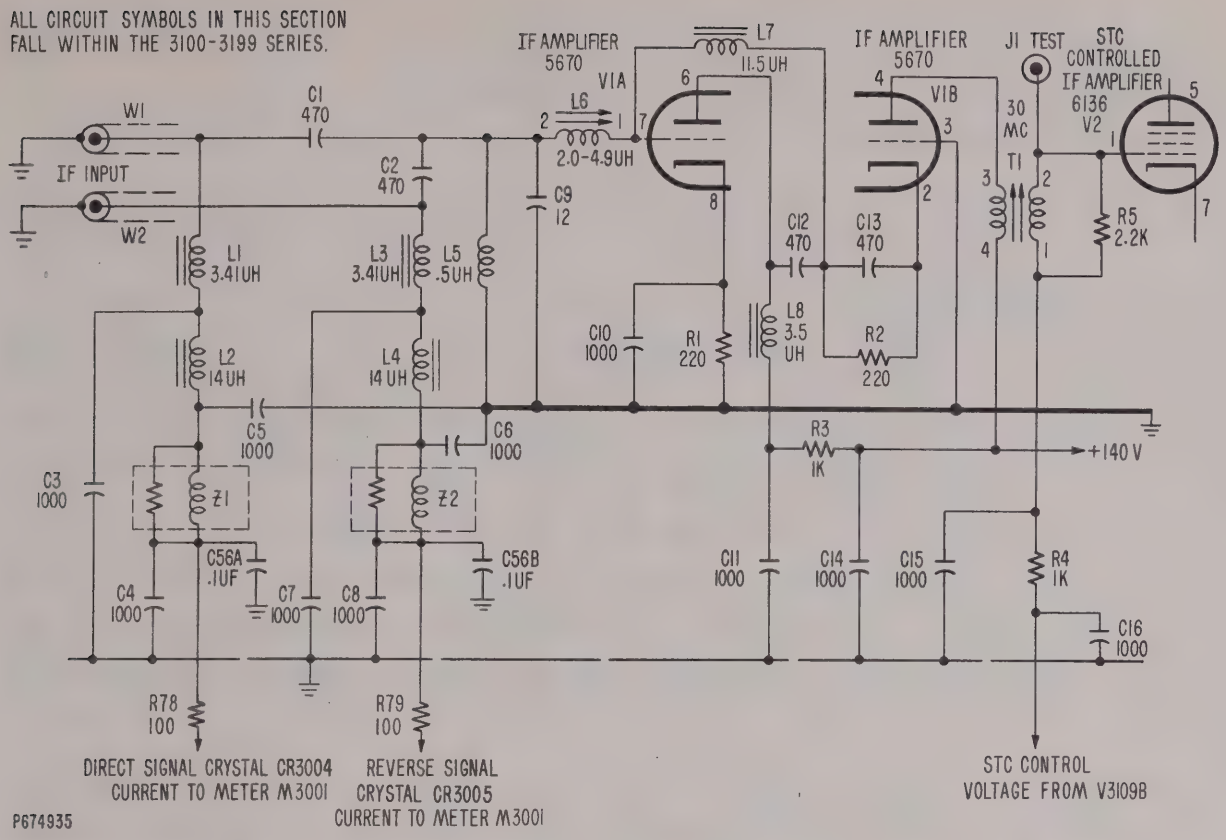


Figure 2-11. Input and Cascode I-F Amplifier Sections of Receiver-Afc Sub-chassis Showing STC Controlled I-F Amplifier Stage, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

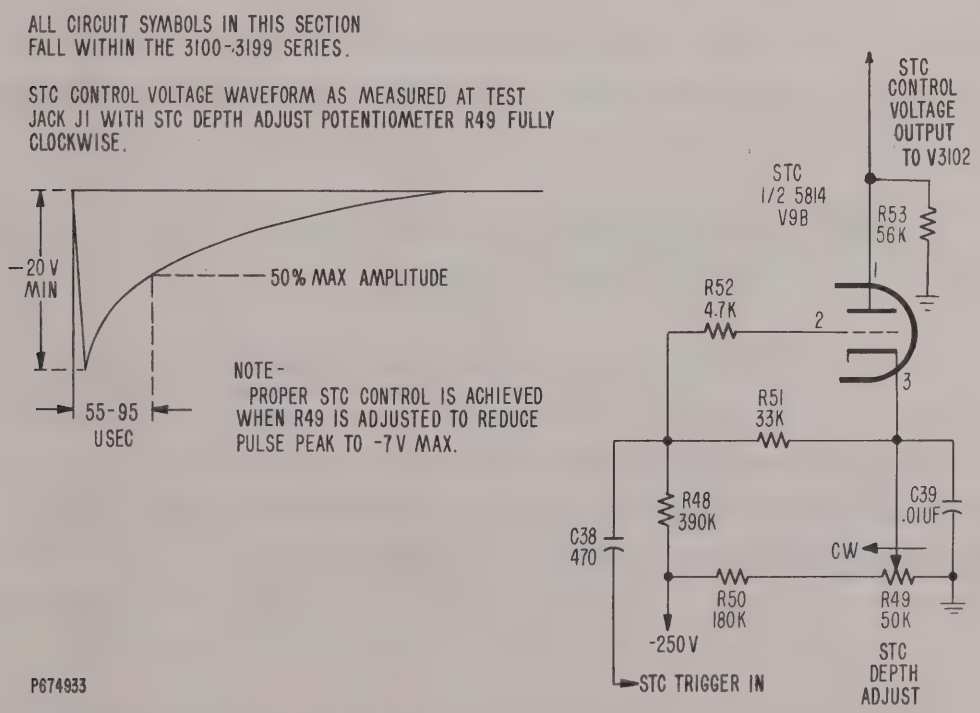

ALL CIRCUIT SYMBOLS IN THIS SECTION FALL WITHIN THE 3100-3199 SERIES.
STC CONTROL VOLTAGE WAVEFORM AS MEASURED AT TEST JACK J1 WITH STC DEPTH ADJUST POTENTIOMETER R49 FULLY CLOCKWISE.
-20 V MIN
50% MAX AMPLITUDE
55-95 USEC
NOTE- PROPER STC CONTROL IS ACHIEVED WHEN R49 IS ADJUSTED TO REDUCE PULSE PEAK TO -7V MAX.
STC CONTROL VOLTAGE OUTPUT TO V3102
STC 1/2 5814 V9B
R53 56K
R52 4.7K
R51 33K
R48 390K
C38 470
C39 .01UF
CW
R50 180K
R49 50K
-250 V
STC TRIGGER IN
STC DEPTH ADJUST
P674933

Figure 2-12. STC Voltage Generator Section of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram and STC Voltage Waveform

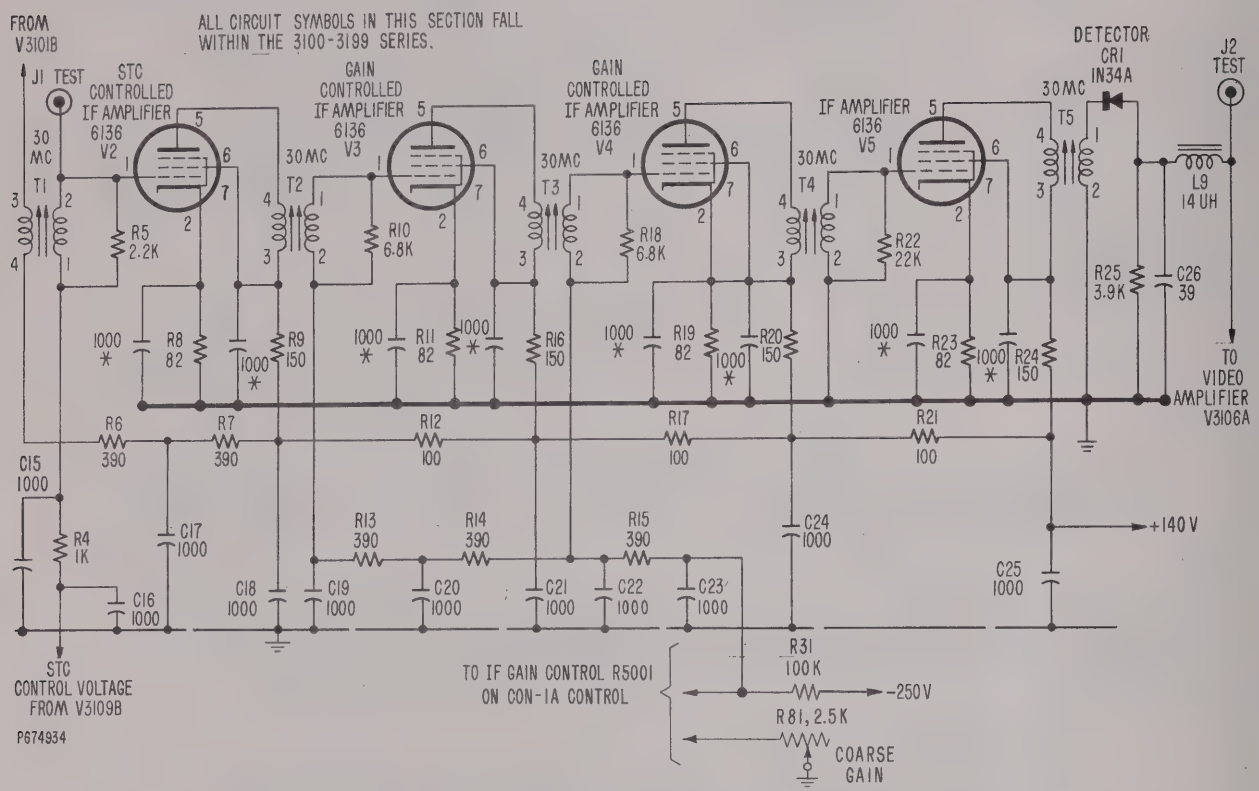


Figure 2-13. I-F Amplifier and Detector Sections of Receiver-Afc Sub-chassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

A combined contour-detector and video-amplifier circuit, with cathode-follower outputs, completes the receiver circuitry.

b. I-F AMPLIFIER SECTION.--The i-f amplifier section consists of two decoupling networks (which also act as crystal-current filters), a cascode i-f amplifier input stage, an STC controlled i-f amplifier stage, two i-f amplifier stages connected for manual (remote) control of gain, one additional conventional i-f amplifier stage, a crystal detector, and an STC voltage generator.

(1) INPUT.--Signal input to the receiver is made through cables W3101 and W3102 to two decoupling networks. (See figure 2-11.)

One decoupling network includes inductors L3101 and L3102, capacitors C3103, C3104, C3105, and C3156A, network Z3101, and resistor R3178.

The other decoupling network includes inductors L3103 and L3104, capacitors C3107, C3108, and C3156B, network Z3102, and resistor R3179.

Inductors L3101 and L3103 also function as mixer load chokes, from which the mixer signals are coupled by capacitors C3101 and C3102 to the grid, pin 7, of triode amplifier V3101A. The input circuit is tuned to the i-f center frequency of 30 megacycles by capacitor C3109, series peaking coil L3106 and parallel peaking coil L3105.

Since the i-f signal applied to the first i-f stage is relatively weak, having had no r-f amplification ahead of the mixer, it is necessary for the first i-f amplifier to have large amplification with the smallest possible noise generation. This requirement is accomplished in the cascode circuit of V3101, in which two triodes are connected in cascode, one as a grounded cathode amplifier, the second as a grounded grid amplifier. This arrangement provides the gain and bandwidth of a single pentode, but with the noise generation almost halved.

Grid bias for V3101A is developed across cathode resistor R3101 and bypass capacitor C3110. Choke L3108 is the plate load and capacitors C3112 and C3113 feed the signal to the cathode of V3101B. Bias voltage for V3101B is developed across cathode resistor R3102 in series with L3107, L3106, and L3105. Neutralization of this triode is not necessary, since the grounded grid effectively shields the signal source input (cathode) from the signal output (plate).

The input impedance of V3101B is very low and this low impedance loads V3101A so heavily that its voltage gain is about 1, and there is no tendency for it to oscillate even without neutralization. The loading is so heavy that the interstage bandwidth (between V3101A and V3101B) is very great.

In order to minimize V3101B noise, the impedance seen when looking back from the cathode of V3101B must be large compared to the equivalent noise resistance at this cathode. To make this impedance as high as possible, inductor L3107 is connected between plate and grid of V3101A. The inductance of L3107 resonates with the plate-grid capacity of V3101A at the intermediate frequency. This inductance is not needed for stability but it does improve the noise figure of the circuit.

The output from cascode i-f amplifier V3101 is fed to the first of four i-f amplifier stages, figure 2-13, in which four pentode tubes are coupled by five double-tuned i-f transformers. Transformer coupling to the inputs of V3102, V3103, V3104, and V3105 is identical but the output transformer of V3105 is different in order to match the load placed on the secondary by crystal detector CR3101. The cathode bias circuit of each tube is identical and consists of an 82-ohm resistor and 1000-micromicrofarad bypass capacitor.

The grid bias of i-f amplifiers V3103 and V3104 can be manually adjusted by the "GAIN" control on CON-1A Control which can vary the bias from 0 to approximately -6 volts dc.

The grid bias of i-f amplifier V3102 is modified by the output voltage of STC tube V3109B (figure 2-12). The action of this circuit is described in paragraph 2-10b(2) following.

(2) STC CIRCUIT.--The amplitude of echo signals varies as a second power inverse function of target range for beam-filling targets such as clouds. Without control of receiver gain, the PPI presentation of cloud targets being approached would vary in intensity from very strong signals at short range to considerably weaker signals at long range.

The object of the STC (sensitivity time control) circuit is to insure that echo signals are presented with approximately equal intensity from similar targets ranging from near zero to approximately 25 nautical miles, and to prevent limiting, in the i-f section of the receiver, by strong signals from close targets.

STC tube V3109B is triggered simultaneously with the transmitter, and at the same repetition rate. For each trigger the STC circuit (figure 2-12) develops an exponentially decaying negative bias voltage which is applied to the grid of STC controlled i-f amplifier tube V3102 (figure 2-11).

Thus, the receiver gain, being reduced to a relatively small value at the instant each trigger pulse is applied to the STC tube V3109B, is permitted to rise for a time interval, following each transmitted pulse, according to an inverse exponential curve. The result is that all echo signals from similar targets ranging from near zero to approximately 25 miles are presented with relatively equal intensity.

With variable resistor R3149 (figure 2-12) set fully clockwise, the output pulse from the STC circuit, as seen on an oscilloscope connected to test jack J3101 (figure 2-11), should have the characteristics as shown in the waveform drawing in figure 2-12. To provide the proper depth of STC control, variable resistor R3149 is adjusted counterclockwise until a setting is obtained which produces, at range of 3 miles, a gain reduction of 18.5 db from the gain at 25 miles; and at range of one mile, a gain reduction of approximately 28 db below maximum.

In operation, STC tube V3109B is triggered by the 50-60-volt, 10-microsecond, positive pulses generated in the SYN-1B Synchronizer-Amplifier-Power Supply. The trigger pulse is coupled by capacitor C3138 and current limiting resistor R3152 to the grid of STC tube V3109B across the grid bias voltage divider network consisting of resistors R3148, R3149, R3150, and R3151. Capacitor C3139 is a cathode bypass for the cathode resistor (depth control R3149).

STC tube V3109B is normally biased below cutoff and the tube has no output. When a positive trigger is applied to the grid, pin 2, the tube conducts. The resulting plate current in load resistor R3153 develops the leading edge of the negative STC voltage which charges timing capacitors C3115 and C3116. The exponentially decaying negative STC voltage is developed as timing capacitors C3115 and C3116 discharge through plate load resistor R3153. Both timing capacitors are equal in value (0.001 microfarad) and are connected in parallel.

At the instant the STC pulse is applied to the grid, pin 1, of STC controlled i-f amplifier tube V3102, the gain of the tube is reduced to a low level; it is then allowed to recover to its normal gain at an exponential rate, as determined by the time constant of RC network consisting of resistors R3104, R3153 and capacitors C3115, C3116.

(3) MANUAL GAIN CONTROLLED I-F AMPLIFIER STAGES.--I-f amplifier tubes V3103 and V3104 (figure 2-13) are so connected that the d-c bias on their control grids can be manually adjusted from a remote point; thereby altering the gain of the i-f amplifier section, as desired, over a fixed range.

A fixed minimum of i-f gain is set by the adjustment of coarse gain control R3181, a 2500-ohm variable resistor on the receiver chassis (figure 2-13). R3181 is connected in series with the manual (fine) gain control, R5001 on the CON-1D Control, and divider resistor R3131 in the minus 250-volt bus. The (fine) gain control R5001 can vary the bias on V3103 and V3104 over a range of approximately six volts. The coarse gain control R3181 has a control range of approximately 6.0 volts.

(4) CONVENTIONAL I-F AMPLIFIER STAGE.--The final i-f amplifier tube V3105 is part of a conventional i-f amplifier stage. The i-f output transformer T3105 is designed to match the load placed on its secondary by crystal detector CR3101.

(5) DETECTOR.--Crystal detector CR3101, a type 1N34A crystal diode, is connected across the secondary of i-f transformer T3107 in series with load resistor R3126. The output of the i-f amplifier section is rectified by detector crystal CR3101 and is fed as video signals to the video-contour amplifier section of the receiver.

Capacitor C3126 and inductor L3109 act as an i-f filter network. Jack J3102 serves as a convenient video test point for observing the detector output waveform.

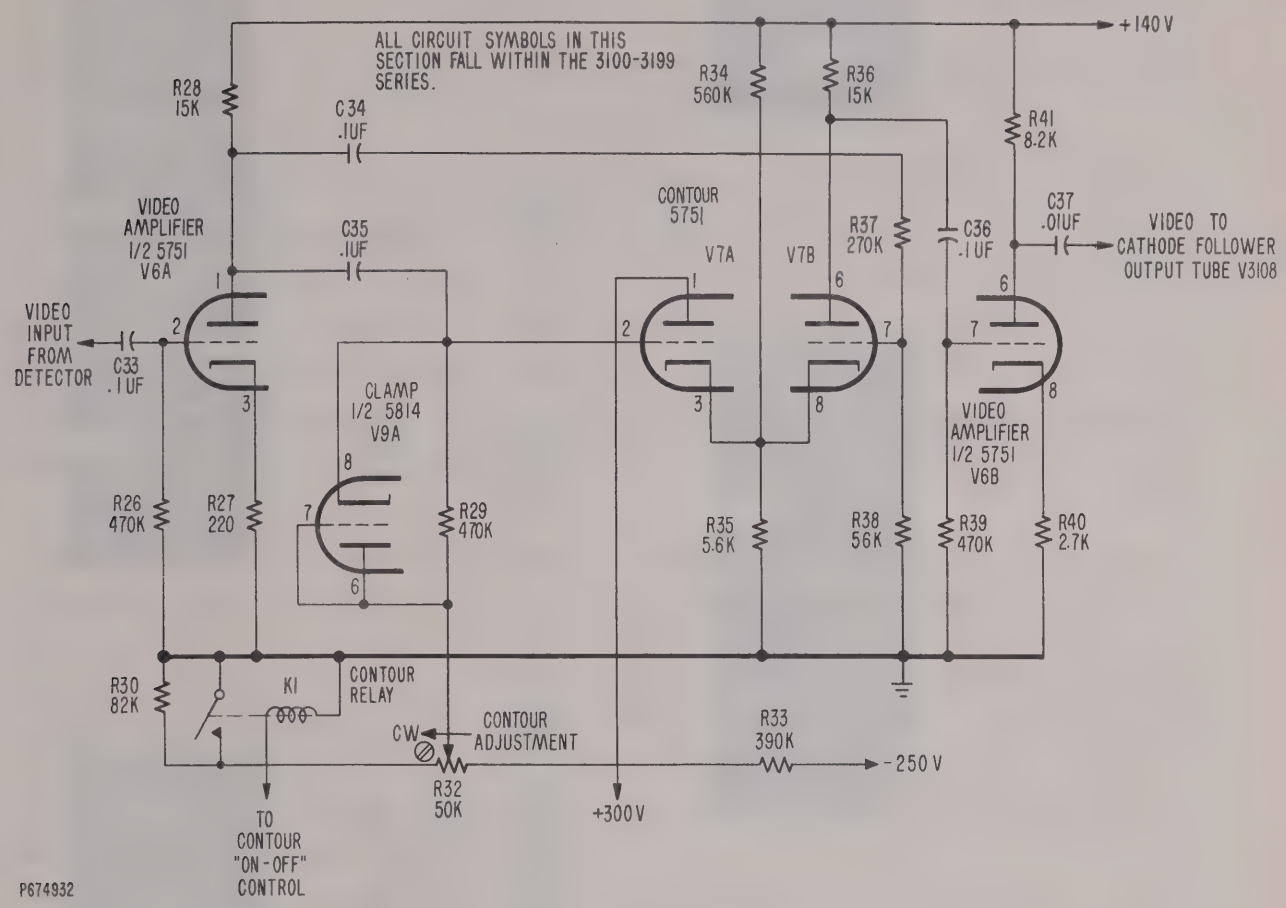


Figure 2-14. Video-Contour Amplifier Section of Receiver-Afc Subchassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

c. VIDEO-CONTOUR AMPLIFIER SECTION.--The video-contour amplifier section consists of an input video amplifier, a dual function video-contour amplifier, a video clamp, a final video amplifier, and dual cathode-follower outputs.

Figure 2-14 is a schematic diagram of the video-contour amplifier section of the receiver. This section operates in one or the other of two modes depending on the position of "CONTOUR-OFF" switch S5002 on the CON-1A Control. When switch S5002 is in the "OFF" position, this section of the receiver acts as a straightforward video amplifier. When switch S5002 is in "CONTOUR" position, circuit

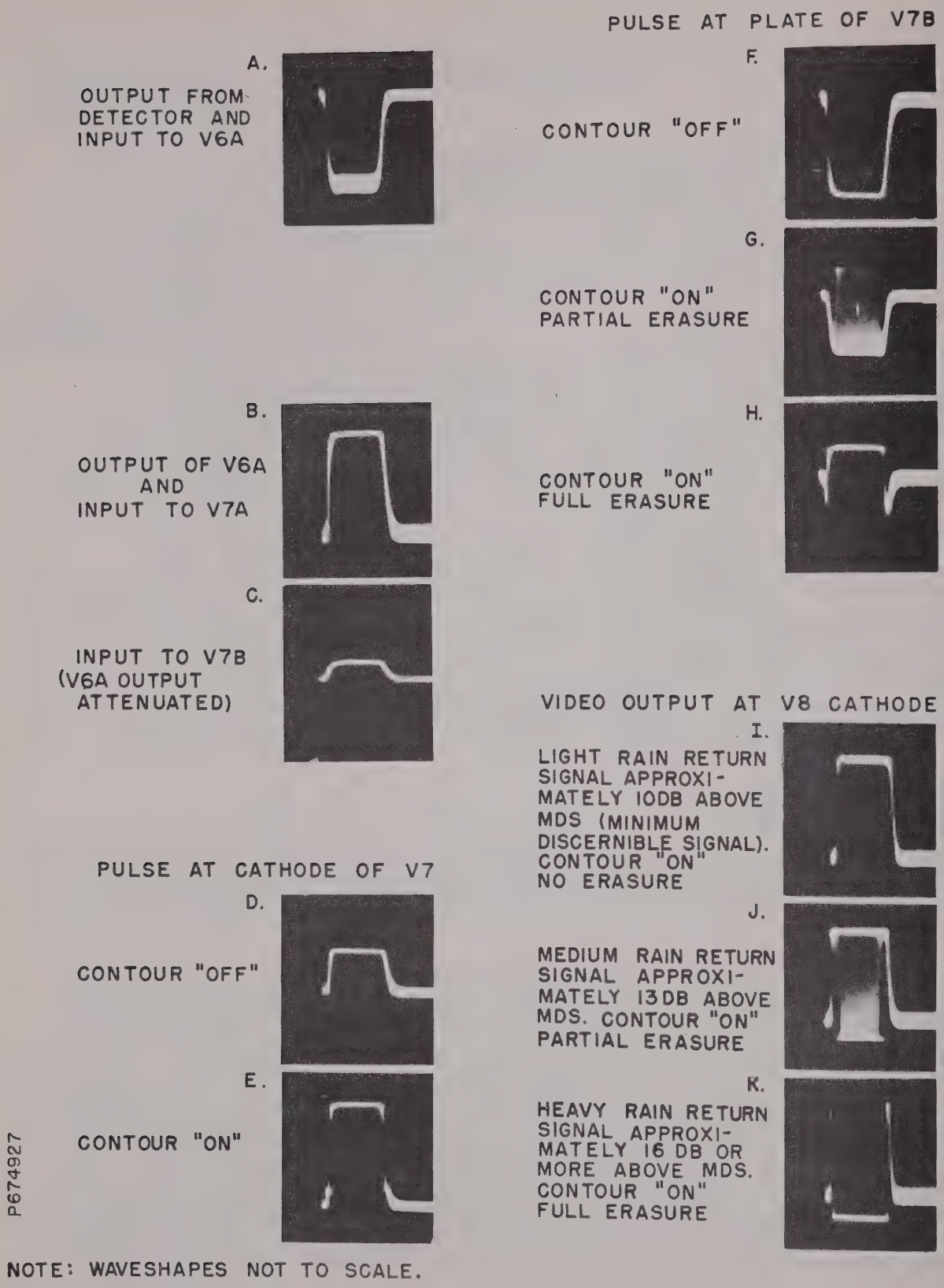

A.
OUTPUT FROM DETECTOR AND INPUT TO V6A
B.
OUTPUT OF V6A AND INPUT TO V7A
C.
INPUT TO V7B (V6A OUTPUT ATTENUATED)
PULSE AT CATHODE OF V7
D.
CONTOUR "OFF"
E.
CONTOUR "ON"
PULSE AT PLATE OF V7B
F.
CONTOUR "OFF"
G.
CONTOUR "ON" PARTIAL ERASURE
H.
CONTOUR "ON" FULL ERASURE
VIDEO OUTPUT AT V8 CATHODE
I.
LIGHT RAIN RETURN SIGNAL APPROXIMATELY 10DB ABOVE MDS (MINIMUM DISCERNIBLE SIGNAL). CONTOUR "ON" NO ERASURE
J.
MEDIUM RAIN RETURN SIGNAL APPROXIMATELY 13DB ABOVE MDS. CONTOUR "ON" PARTIAL ERASURE
K.
HEAVY RAIN RETURN SIGNAL APPROXIMATELY 16 DB OR MORE ABOVE MDS. CONTOUR "ON" FULL ERASURE
P674927
NOTE: WAVESHAPES NOT TO SCALE.

Figure 2-15. Reference Waveforms, Contour Circuit

changes occur which enable this circuit to erase signals above a preselected level. It is this feature which makes the detection of storm cells possible.

In operation, detected signals are applied to the control grid of video amplifier tube V3106A in the form of negative-going video pulses. (See A of figure 2-15.) The pulses are amplified, inverted, and coupled through capacitors C3134 and C3135 to both control grids of V3107. Positive-going pulses applied to V3107B are attenuated by voltage dividing resistors R3137 and R3138; the amplitide of these pulses will be approximately one-fifth that of the positive-going pulses applied to V3107A. (See B and C of figure 2-15.)

(1) NORMAL OPERATION, CONTOUR "OFF".--In normal operation ("CONTOUR-OFF" switch S5002 on CON-1A Control in "OFF" position) contour relay K3101 is in its open position, as shown in figure 2-14, and contour tube V3107A is biased so far below cutoff that it is effectively out of the circuit. Bias for V3107A is obtained from the arm of variable resistor (contour adjustment) R3132 which, together with resistors R3130 and R3133, form a voltage divider network in series with the -250-volt bus.

With V3107A out of the circuit, V3107B acts as a normal video amplifier. Positive pulses applied to the grid of V3107B are amplified, inverted, and fed as negative-going pulses, through coupling capacitor C3136 to the grid of video amplifier tube V3106B. (See figure 2-15, F.)

The output of video amplifier V3106B results in positive pulses which are fed through coupling capacitor C3137 to two separate cathode follower output channels.

(2) CONTOUR OPERATION.--When "CONTOUR-OFF" switch S5002, on CON-1A Control, is in "CONTOUR" position, 28 volts dc is applied to contour relay K3101 closing the relay contacts. This action shorts out divider resistor R3130 lowering the bias applied to contour tube V3107A to some degree below cutoff,

as determined by the setting of variable resistor (contour adjustment) R3132. Contour tube V3107B is normally lightly conducting.

Positive pulses at the grid of V3107B immediately result in negative pulses at its plate, but the positive pulses at the grid of V3107A have to overcome the applied bias before V3107A can conduct; therefore, all signals below a level predetermined by the setting of variable resistor R3132 are blocked at V3107A but see V3107B as a video amplifier and appear as amplified, positive-going video pulses across cathode resistors R3145 and R3146 of the cathode-follower output tubes V3108A and V3108B (figure 2-16). All such positive pulses will appear as bright displays on the face of the cathode-ray indicator tube in the PPI, indicating moisture-bearing cloud formations lacking storm cells of dangerous magnitude.

However, when the radar beam encounters rain of sufficient density to increase the return signal amplitude by approximately 12 to 16 db (depending upon the setting of R3132) above the MDS (minimum discernible signal) level, the signal at the grid of V3107A will overcome the bias and the tube will begin to conduct. When V3107A conducts, more current flows through cathode resistor R3135, increasing the voltage drop across it and increasing the bias on V3107B proportionately. As the signal on the grid of V3107A increases above cutoff, V3107A conducts more heavily, biasing V3107B at a level sufficient to override the attenuated signal on its grid. When this happens, the signal is effectively erased, since no display results when the output of V3107B is at, or more positive than its quiescent state (conducting normally).

Illustrations I, J, and K of figure 2-15 are scope photographs of the video output pulses appearing across cathode resistors R3145 and R3146 of the cathode-follower video output tubes V3108A and V3108B, and, therefore, at output jacks J3104 and J3105 for transmission to PPI indicators.

"I" is the pulse resulting from a return signal of amplitude below the threshold level of V3107A and is not affected by contour action. The level of

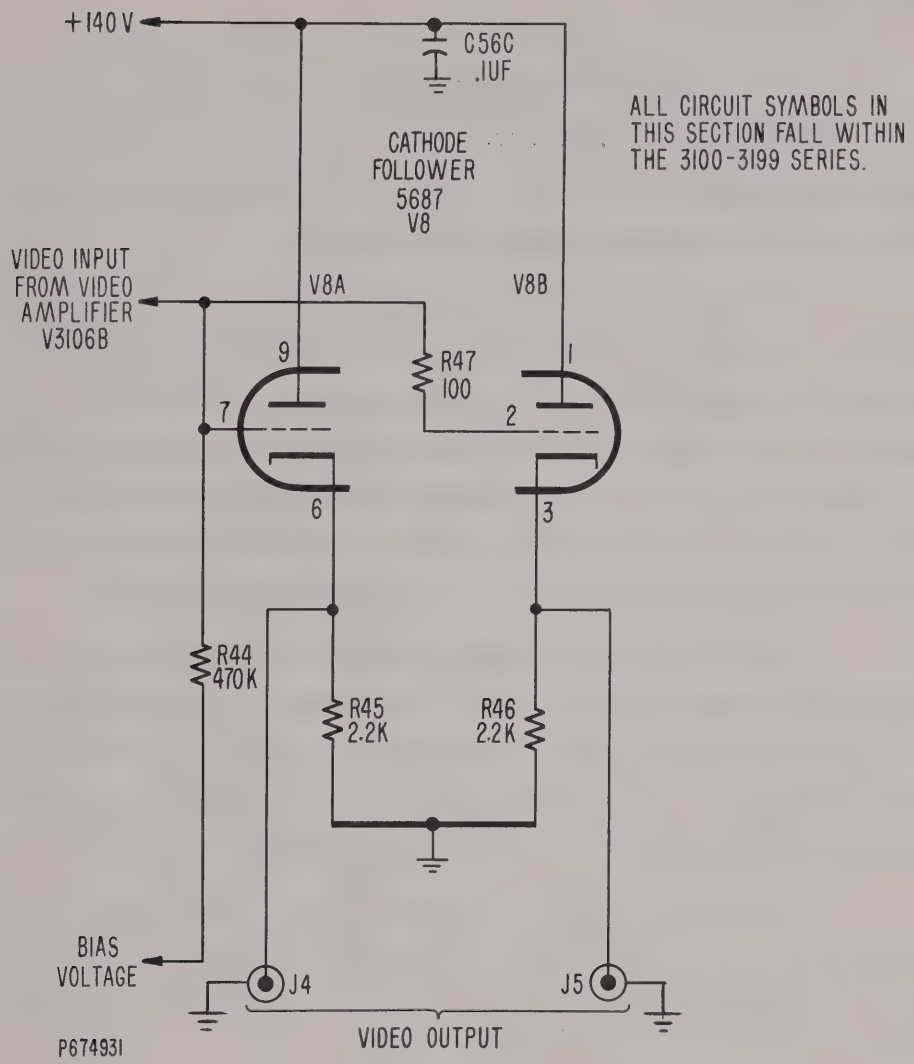


Figure 2-16. Video Output Section of Receiver-Afc Subchassis, Part of RDR-1C Transmitter-Receiver, Partial Schematic Diagram

such a signal may be up to approximately 10 db above the MDS (minimum discernible signal) level. An MDS signal will be returned from a cloud area of "near-zero-rain". Such a pulse will appear as a bright spot on the PPI.

"J" is the pulse resulting from a return signal of amplitude just above the threshold level of V3107A, with contour circuit operating. At this input signal level, approximately 13 db above MDS, V3107A just starts to conduct and the effect can be seen as a partial erasure of the signal.

"K" is the pulse resulting from a return signal of amplitude greater than necessary to completely overcome the bias on V3107A. The level of such a signal may be approximately 14 db to 16 db or more above the MDS level, depending on the setting of variable resistor R3132. Such a signal would be returned from a heavy rain area. In this case, part of the resulting video output at the cathodes of V3108A and V3108B is negative, which has the effect of a blacker-than-black signal, since only a positive pulse output will produce a bright display on the PPI.

V3106B is ideally biased as a video amplifier with a restricted dynamic range while cathode-follower output tubes V3108A and V3108B (figure 2-16) are biased very near cutoff. Three advantages are gained by holding the bias of V3108A and V3108B near cutoff; a conservation of power is realized, the demand on the contour circuit is reduced, and negative overshoot of the output pulse is held to a minimum.

Clamp tube V3109A is connected as a diode in the grid circuit of V3107A and functions as a d-c restorer to maintain a fixed bias level at the grid of V3107A as determined by the setting of contour level adjusting potentiometer R3132.

2-11. METERING CIRCUITS.

a. CRYSTAL CURRENT METERING.--The metering circuit, partially shown in figure 2-17, provides a quick check on several of the operating functions of the RDR-1C Transmitter-Receiver as outlined below. The metering circuit consists of panel meter M3001, a 0-1.0-milliampere d-c meter; circuit selector switch S3001; a six-position, two-pole wafer switch; meter shunt resistor R3011 in the magnetron cathode circuit (figure 2-3); afc crystal filter network in the afc circuit (figure 2-8); and two signal crystal filter networks in the receiver circuit (figure 2-11).

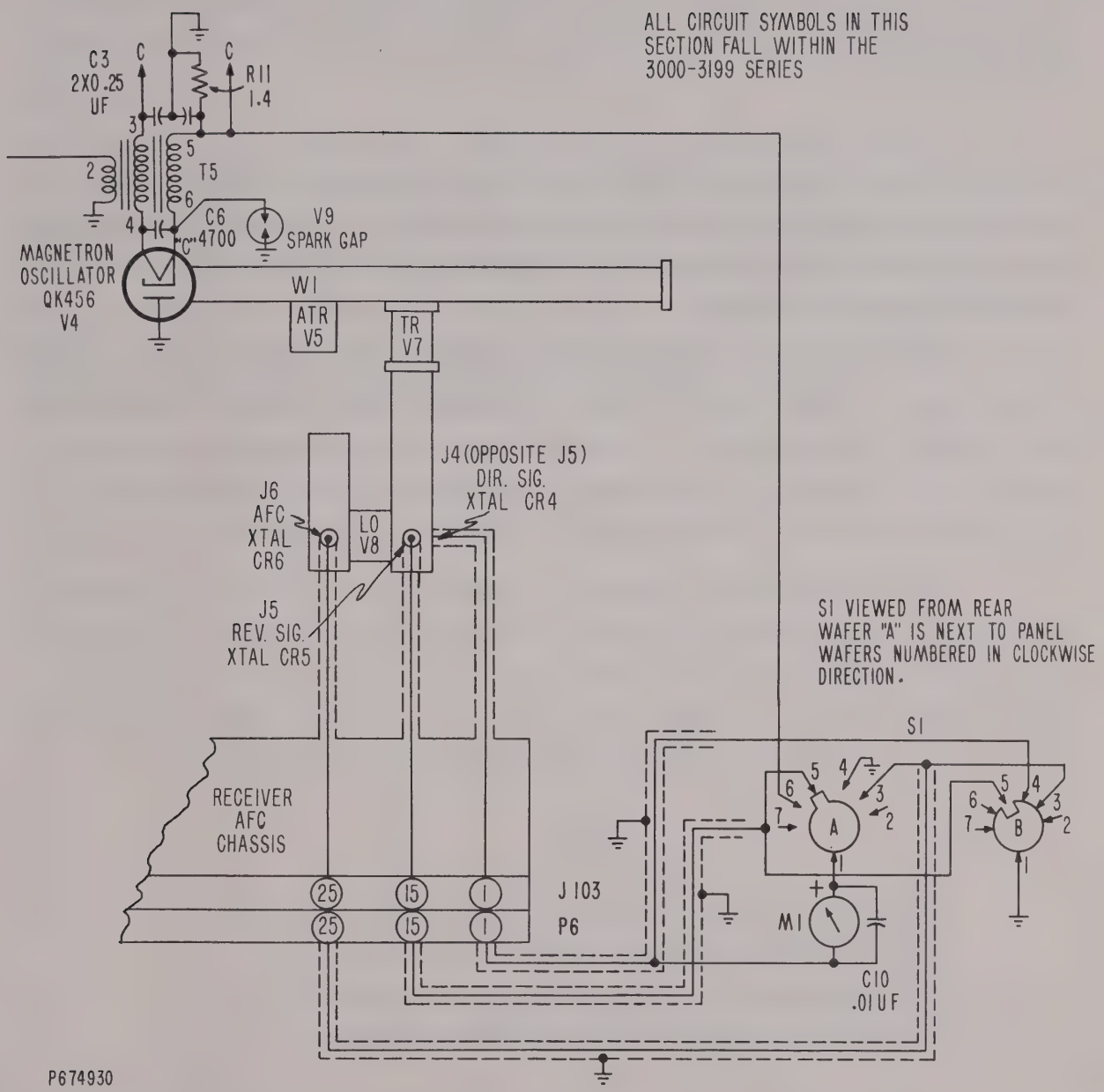


Figure 2-17. Current Metering Circuits of RDR-1C Transmitter-Receiver, Simplified Schematic Diagram

THEORY OF OPERATION

Positions 2 and 7 of meter circuit selector switch S3001 (figure 2-17) represent the "OFF" positions and are so indicated on the front panel. The switch is shown in position 5, which connects meter M3001 into the reverse signal crystal current circuit.

Starting with position 6 of S3001 (figure 2-17), meter M3001 is connected to read the average cathode current of an operating magnetron oscillator. This position of S3001 is indicated as "MAG" on the front panel. A half-scale reading on the meter M3001 indicates an average cathode current of 9 to 11 milliamperes for a normally-operating magnetron.

With switch S3001 in position 5, meter M3001 is connected to read current from reverse signal crystal CR3005 in the signal mixer section of the duplexer-mixer assembly W3001 (figure 2-6). This position of switch S3001 is indicated as "A-SIG" on the front panel. A half-scale meter reading in this position indicates a normal crystal current of 0.5 milliampere. (Refer to note following next paragraph.)

With switch S3001 in position 4, meter M3001 is connected to read current from direct signal crystal CR3005 in the signal mixer section of the duplexer-mixer assembly W3001 (figure 2-6). This position of switch S3001 is indicated as "B-SIG" on the front panel. A half-scale meter reading in this position indicates a normal crystal current of 0.5 milliampere. (Refer to note which follows.)

NOTE

The direct and reverse signal currents referred to in the two preceding paragraphs must each read between 0.4 milliampere and 0.6 milliampere, on panel meter M3001, for a pair of crystals having satisfactory balance.

With switch S3001 in position 3, meter M3001 is connected to read current from afc crystal CR3006 in the afc mixer section of the duplexer-mixer assembly W3001 (figure 2-6). This position of switch S3001 is indicated as "AFC" on the

front panel. A half-scale, needle-steady reading in this position indicates a normal crystal current of 0.5 milliampere and also indicates afc lock-in with the transmitted pulse. If the afc is not locked in with the transmitted pulse, the meter needle will oscillate over a wide arc. An oscillating needle normally indicates an off-frequency local oscillator.

b. RUNNING TIME METER.--An additional meter (elapsed running time meter M3002) is included on the front panel of the unit and is used to indicate the total time, in hours, of radar set operation in "STANDBY" and "ON" attitudes combined. This meter is calibrated in hours, from 0 to 1000, and a pointer registers the total elapsed running time. Meter M3002 is connected across the primary 115-volt, 380-420-cps power whenever standby relay K3002 is closed.

SECTION III
INSTALLATION

3-1. GENERAL.

The RDR-1 (C-band) Airborne Radar System Instruction Book I.B. 733 contains installation instructions for the entire radar system and includes a system interconnecting wiring diagram as well as dimensional outline drawings of the equipment. The system installation, including the type RDR-1C Transmitter-Receiver, should be made in accordance with the information contained in that book.

An additional set of the dimensional outline drawings for the RDR-1C Transmitter-Receiver and SHK-1C Shockmount is included in this section for ready reference. (See figures 3-1 and 3-2.)

Figure 3-1. RDR-1C Transmitter-Receiver, Dimensional Outline Drawing

SECTION III
INSTALLATION

3-1. GENERAL.

The RDR-1 (C-band) Airborne Radar System Instruction Book I.B. 733 contains installation instructions for the entire radar system and includes a system interconnecting wiring diagram as well as dimensional outline drawings of the equipment. The system installation, including the type RDR-1C Transmitter-Receiver, should be made in accordance with the information contained in that book.

An additional set of the dimensional outline drawings for the RDR-1C Transmitter-Receiver and SHK-1C Shockmount is included in this section for ready reference. (See figures 3-1 and 3-2.)

NOTE 1. IF STANDARD MOUNTING BASE IS NOT USED, AN RT ADAPTER (BENDIX C244177-1) WILL BE REQUIRED BETWEEN AIRCRAFT WAVEGUIDE INSTALLATION AND TRANSMITTER OUTPUT FLANGE.

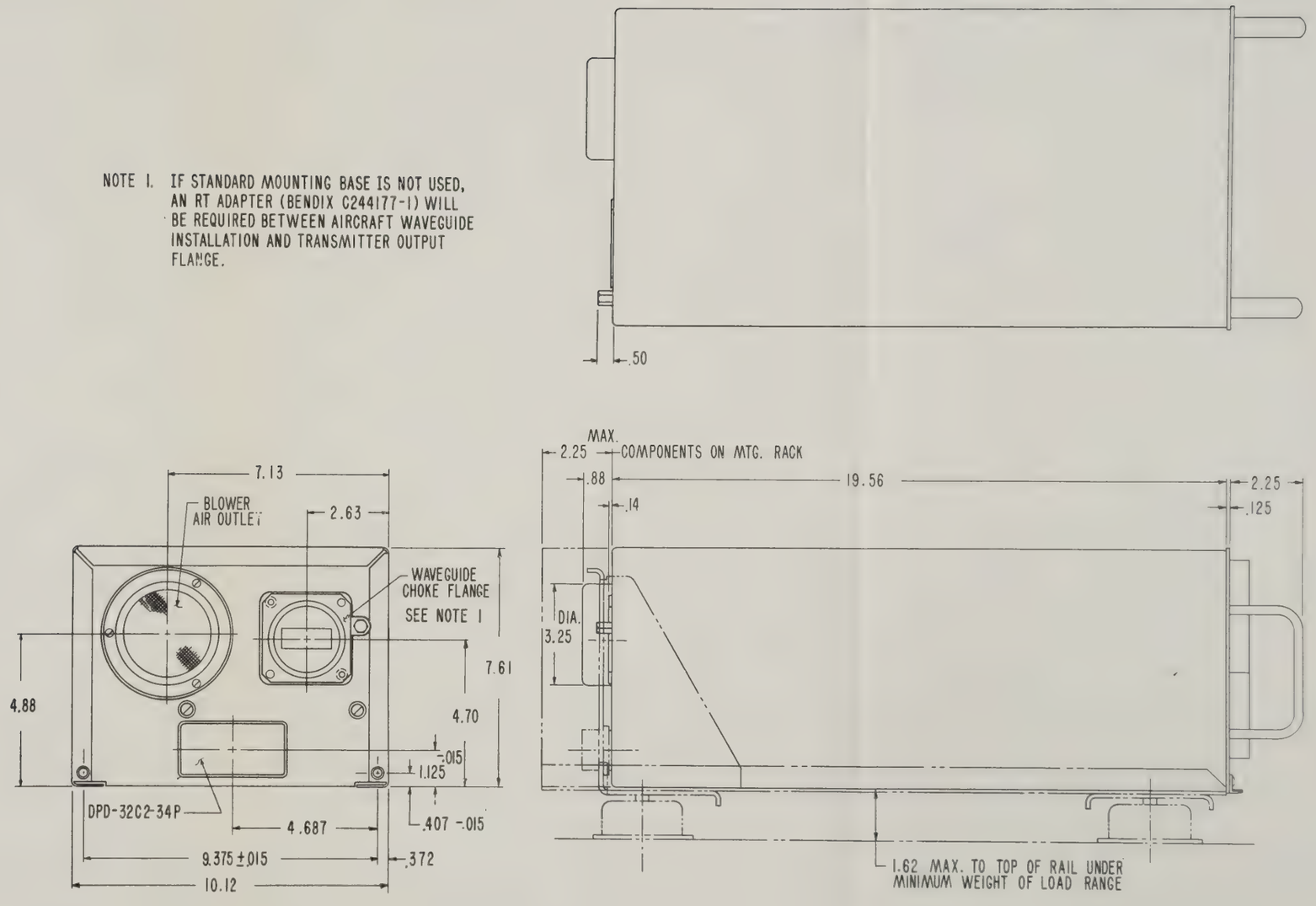
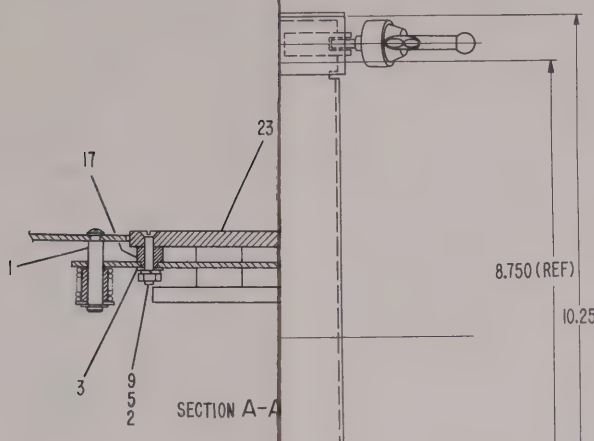
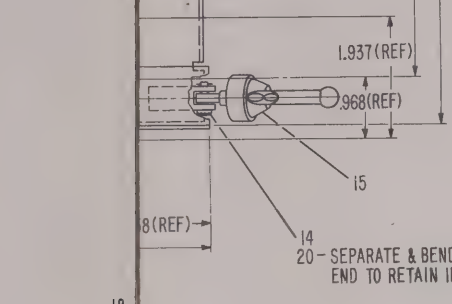
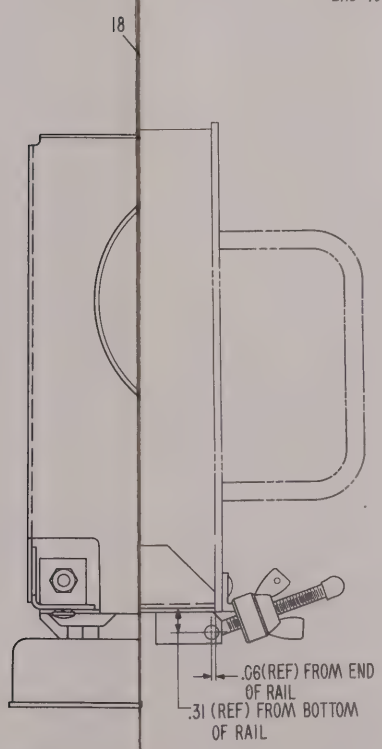


Figure 3-1. RDR-1C Transmitter-Receiver, Dimensional Outline Drawing



NOTE 1. MATES WITH DOUBLE-RIDGE WAVEGUIDE (AIRTRON TYPE ARA-136) TERMINATED WITH PLAIN OR GASKET FLANGE.

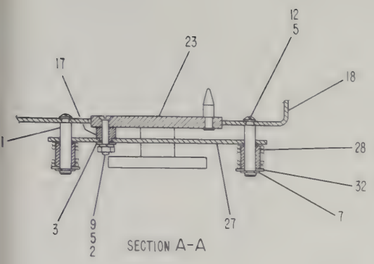


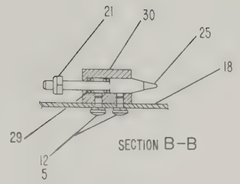


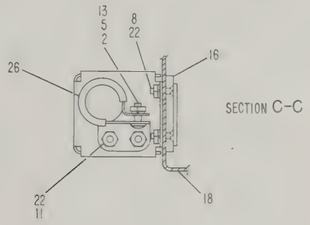
OR 240601

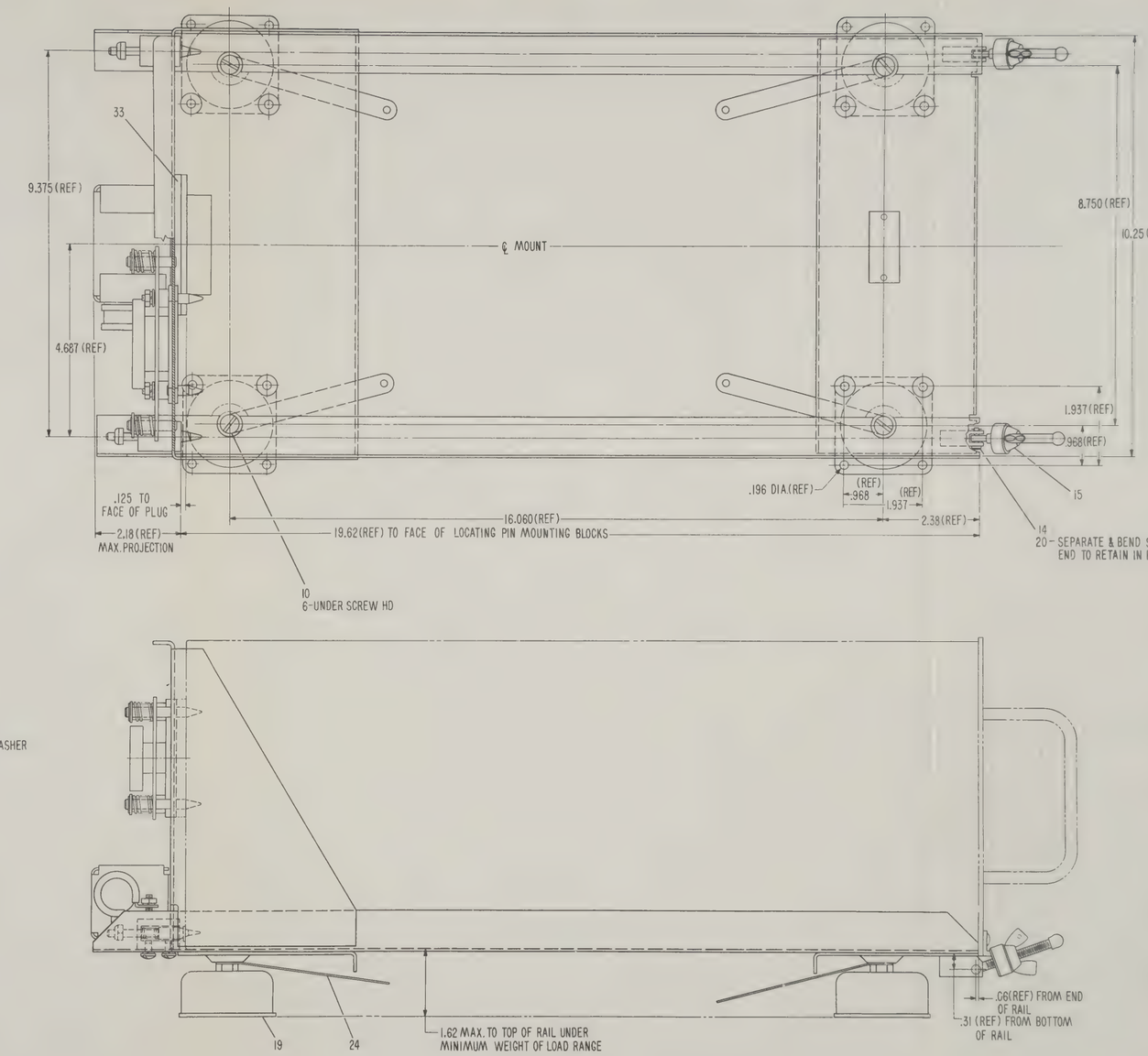
ITEM	PART NO.	NAME	QTY.
33	C686432-1	Block, Mounting	2
32	C240484-1	Bushing	4
31	L693995-1	Cover	1
30	C686284-1	Block	2
29	C681426-2	Spring	2
28	C681483-1	Spring	4
27	C678202-1	Plate, Shock	1
26	C295828-1	Clamp, Electrical	1
25	C295786-1	Pin, Locating	2
24	L294255-5	Strap, Ground	4
23	C244177-1	Waveguide Section	1
22	C241890-5	Nut, Self-Locking	6
21	C241890-4	Nut, Self-Locking	2
20	A241113-6	Pin, Cotter	2
19	C240571-5	Mount, Vibration	4
18	N240625-1	Shockmount Subassembly	1
17	C240393-11	Spacer	2
16	C223410-2	Connector, Receptacle	1
15	C204117-3	Knob Assembly	2
14	A119397-1	Pin	2
13	HN950B14-832	Screw, Binder Hd.	1
12	HN950B10-832	Screw, Binder Hd.	8
11	HN950B08-632	Screw, Binder Hd.	2
10	HN949B12-1620	Screw, Round Hd.	4
9	HN948B28-832	Screw, Flat Hd.	2
8	HN948B18-632	Screw, Flat Hd.	4
7	HC848G-250	Ring, Retaining	4
6	HN799P16-M	Washer, Lock	4
5	HN799P08-M	Washer, Lock	11
4			
3	HN779B08-L	Washer, Flat	2
2	HN775B08-32	Nut, Hex	3
1	C686285-1	Spacer	4

Figure 3-2. SHK-1C Shockmount, Dimensional Outline Drawing

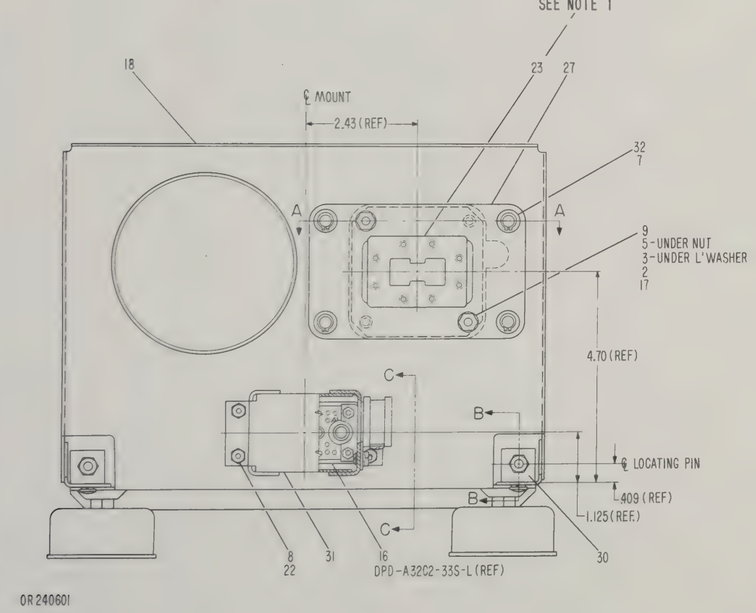








NOTE 1. MATES WITH DOUBLE-RIDGE WAVEGUIDE (AIRTRON TYPE ARA-136) TERMINATED WITH PLAIN OR GASKET FLANGE.



ITEM	PART NO.	NAME	QTY.
33	C686432-1	Block, Mounting	2
32	C240484-1	Bushing	4
31	L693995-1	Cover	1
30	C686284-1	Block	2
29	C681426-2	Spring	2
28	C681483-1	Spring	4
27	C678202-1	Plate, Shock	1
26	C295828-1	Clamp, Electrical	1
25	C205786-1	Pin, Locating	2
24	L294255-5	Strap, Ground	4
23	C244177-1	Waveguide Section	1
22	C241890-5	Nut, Self-Locking	6
21	C241890-4	Nut, Self-Locking	2
20	A241113-6	Pin, Cotter	2
19	C240571-5	Mount, Vibration	4
18	N240625-1	Shockmount Subassembly	1
17	C240393-11	Spacer	2
16	C223410-2	Connector, Receptacle	1
15	C204117-3	Knob Assembly	2
14	A119397-1	Pin	2
13	HN950B14-832	Screw, Binder Hd.	1
12	HN950B10-832	Screw, Binder Hd.	8
11	HN950B08-632	Screw, Binder Hd.	2
10	HN949B12-1620	Screw, Round Hd.	4
9	HN948B28-832	Screw, Flat Hd.	2
8	HN948B18-632	Screw, Flat Hd.	4
7	HC848G-250	Ring, Retaining	4
6	HN799P16-M	Washer, Lock	4
5	HN799P08-M	Washer, Lock	11
4			
3	HN779B08-L	Washer, Flat	2
2	HN775B08-32	Nut, Hex	3
1	C686285-1	Spacer	4

OR 240601

Figure 3-2. SHK-1C Shockmount, Dimensional Outline Drawing

SECTION IV
OPERATION

4-1. GENERAL.

The RDR-1C Transmitter-Receiver contains no manual operating controls; it is controlled remotely from the CON-1A Control unit.

No operating instructions are required other than those included in section IV of the RDR-1 (C-band) Airborne Radar System Instruction Book I. B. 733.

SECTION V
PREVENTIVE MAINTENANCE

5-1. GENERAL.

Section V of the RDR-1 (C-band) Airborne Radar System Instruction Book I.B. 733 contains a step-by-step test procedure to determine the over-all operating condition of the radar system and these procedures should be followed periodically as outlined therein.

Any defect noted in the operation of the RDR-1C Transmitter-Receiver should be corrected immediately by the replacement or repair of the faulty unit as outlined in section IV of this handbook.

In addition to the above, the L-shaped air filter on the front panel of the RDR-1C Transmitter-Receiver must be kept free of dust and dirt accumulations which would interfere with the free flow of air through the unit.

The filter is made available for cleaning by removing the six screws holding the filter material and filter frame to the front panel.

CAUTION

The air filter provided is a reuseable electrostatic filter composed of synthetic fibers and should NOT be cleaned with regular solvents or detergents. As required, the filter should be flushed with water or mild soap solution similar to Lux.

SECTION VI
CORRECTIVE MAINTENANCE

6-1. GENERAL.

This section contains information essential to the maintenance and overhaul of the RDR-1C Transmitter-Receiver. Included in this section is a list of test equipment required for servicing the entire RDR-1 (C-band) Airborne Radar System, suggested bench test facilities, a table of minimum performance standards for the RDR-1C Transmitter-Receiver, test and alignment procedures for the RDR-1C Transmitter-Receiver, and a check list for testing system operation.

If any unusual or special service problems arise, it is suggested that the Service Department, Bendix Radio, Division of Bendix Aviation Corporation, Towson 4, Maryland, be contacted for advice or assistance.

Should it be necessary to ship units to the factory or between operating points, a substantial case made of plywood or equivalent strong material, with braces and felt padding, should be provided.

No equipments should be returned to the factory until a return authorization (RA) form is requested and received from the Service Department of Bendix Radio.

6-2. TEST FACILITIES REQUIRED.

Bendix Radio has developed a special test set and harness for the RDR-1 Airborne Radar System. Use of this test set eliminates the need for removing the antenna and control unit from the aircraft when bench testing and servicing other units of the system.

The test set includes an antenna and control unit simulator as well as special switching and indicating devices to facilitate testing, servicing, and aligning all units

of the system. Additional test equipment requirements are held to a minimum by the use of the test set.

Full information covering the circuitry and use of the test set will be furnished upon written request to the Service Department, Bendix Radio, Division of Bendix Aviation Corporation, Towson 4, Maryland.

Another acceptable method for bench testing and servicing the radar system is represented by a complete system mock-up on the service bench. Figure 6-1 is a line diagram of such a setup; it should be wired in accordance with the system wiring diagram, figure 6-2, which has been modified to permit single-phase operation, thus simplifying the primary power requirements.

Since it is beyond the scope of this handbook to consider each possible bench setup in detail, the above method, employing a complete system mock-up, is used as the basis for the servicing procedures included herein, in which a calibrated SYN-1B Synchronizer-Amplifier-Power Supply is used as the source of secondary voltages, system triggers, and as the amplifier for servo system voltages.

Modifications to this suggested setup can be made at the option of the individual service unit.

The test jigs and test accessories required to supplement the bench setup are listed in table 6-1.

6-3. TEST EQUIPMENT REQUIRED.

Testing, servicing, and aligning the RDR-1 (C-band) Airborne Radar System requires the use of the test equipment listed in table 6-1. The recommended commercial types of test equipment, or their equivalents, may be used. Special test accessories and test jigs must be fabricated by the using organization.

TABLE 6-1. TEST EQUIPMENT REQUIRED--RDR-1 (C-band) AIRBORNE RADAR SYSTEM

Power Bridge, PRD 650-B Bolometer Mount, PRD 628A with a 100-ma bolometer Coax Attenuator, PRD 130-C calibrated at 5400 mc	or	Hewlett-Packard 430-C Hewlett-Packard 477-A Thermister Mount with W.E. 32A3 Thermister Coax Attenuator, Weinschel 210-20 (20-db attenuation)
RT unit adaptor, Bendix C244177-1 Waveguide H-plane 90-degree bend, type ARA-136, Airtron 67367 Impedance matching coupler, transition, double ridge to standard C-band waveguide, Airtron 64027 Dummy load, C-band waveguide termination, Airtron 52152	or	Dummy load, Airtron high-power C-band double-ridge waveguide termination, Airtron

Test Set, Hewlett-Packard, type 618B

Oscilloscope, Tektronix, type 531 with high-impedance probe

Variac, General Radio, type V-10-HMT

Volt-ohmmeter, Triplett, model 630

Signal Generator, Measurements Corp., model 80 or Hewlett-Packard, type 608D

Pulse Generator, Measurements Corp., model 79B or Hewlett-Packard 212A

Dummy mixer (receiver) (See note 1.)

Probe, traveling detector (See note 1.)

Dummy mixer (afc) (See note 1.)

VTVM, Hewlett-Packard, model 410B

Sweep Generator, Rada-Sweep

Echo Box, C-band, Narda, model 833

Frequency counter, Hewlett-Packard, type 524A

Roll and Pitch voltage source, Bendix GYA-1A (vertical gyro)

D-c voltmeter, 0-30 volts, Weston 931

Test Jig, CON-1( ) (See note 2.)

TABLE 6-1. TEST EQUIPMENT REQUIRED--RDR-1 (C-band) AIRBORNE RADAR SYSTEM (cont)

Test Jig, SYN-1B (See note 3.)
Test Jig, ANT-1( ) (See note 4.)
Wedge, 10-degree slope

Notes:
1. See figure 6-3 for construction details.
2. Refer to Instruction Book I.B. 734, covering CON-1( ) Controls, for construction details.
3. Refer to Instruction Book I.B. 739, covering SYN-1B Synchronizer-Amplifier-Power Supply, for construction details.
4. Refer to Instruction Book I.B. 735, covering ANT-1( ) Antenna, for construction details.

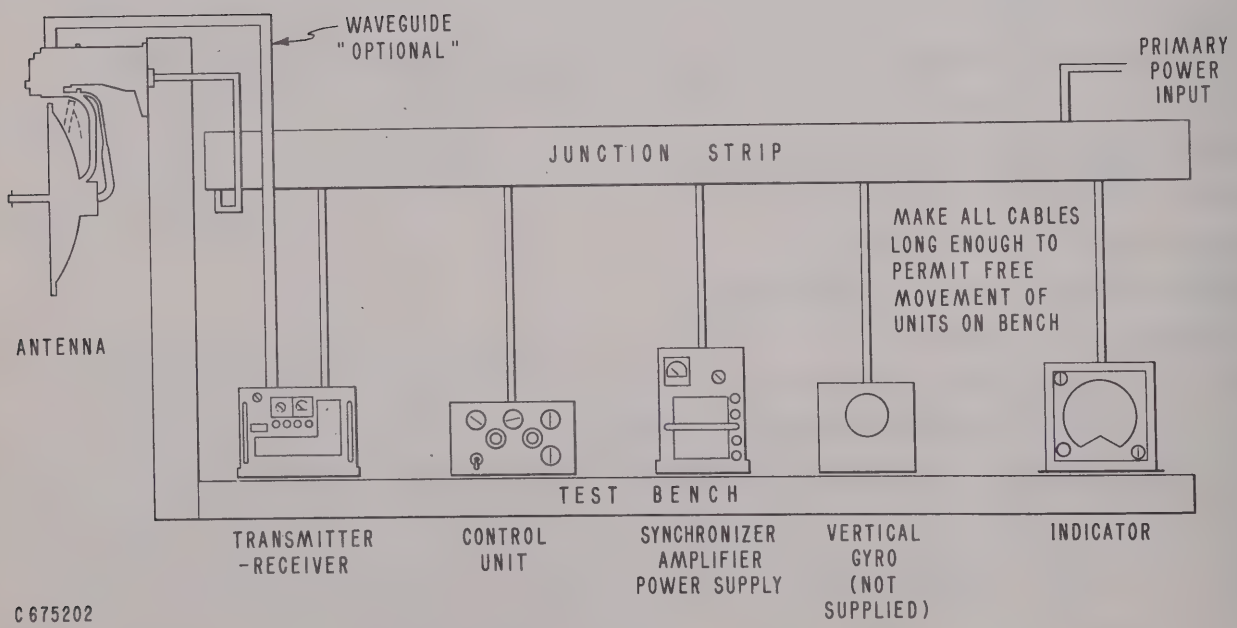


Figure 6-1. Test Bench Setup, RDR-1 Airborne Radar System (Suggested Layout), Block Diagram

STRIP THE SHIELDS
N STRIP TERMINAL

LACED IN WITH THE
(TYPE RG-59/U)
TE 8.
R INPUT CONNECTOR
E NOTE 8.
FEEDS TO PIN "H"

P ARE SHOWN BELOW
T TO JUNCTION STRIP

E WIRE SHIELDED.

7. CONNECTIONS TO ROLL AND PITCH OUTPUT OF THE VERTICAL GYRO MUST BE MADE AS FOLLOWS:
   TO ECLIPSE-PIONEER PB10 AMPLIFIER AND SIGNAL GENERATOR PLUG J4;
   FOR RIGHT SIDE INSTALLATION OF AUTOPILOT, CONNECT TO TERMINALS AS IN "A1".
   FOR LEFT SIDE INSTALLATION OF AUTOPILOT, CONNECT TO TERMINALS AS IN "A2".
   TO SPERRY AUTOPILOT A12, CONNECT TO WIRES FROM J7 AS IN "A3" USING PROPER ISOLATION TRANSFORMER TO CHANGE VERTICAL GYRO OUTPUT TO STANDARD ARINC ROLL AND PITCH INPUT. (SPERRY ISOLATION TRANSFORMER NO.661711)
   TO GYA-1A JUNCTION BOX PLUG J101, CONNECT TO TERMINALS AS IN "A4"; USE MATING CONNECTOR AN-3106-20-15S (STRAIGHT), OR AN-3108A-20-15S (ANGLE).

8. ON TYPE PPI-1B INDICATORS THE POWER INPUT CONNECTOR P1001 AND THE VIDEO INPUT CONNECTOR P1002 ARE REMOVED FROM THE REAR OF THE INDICATOR CHASSIS AND ARE COMBINED IN ONE CONNECTOR (P1001) WHICH TERMINATES A PENDANT CABLE FROM THE INDICATOR.
   PIN 19 IS THE VIDEO INPUT TERMINAL OF P1001 ON PPI-1B INDICATORS; THE VIDEO CABLE SHIELD CONNECTS TO PIN 20.

9. UNBROKEN COAX RUNS ARE PREFERABLE. IF BREAK IS NECESSARY USE TYPE BNC CONNECTOR AT BREAK.

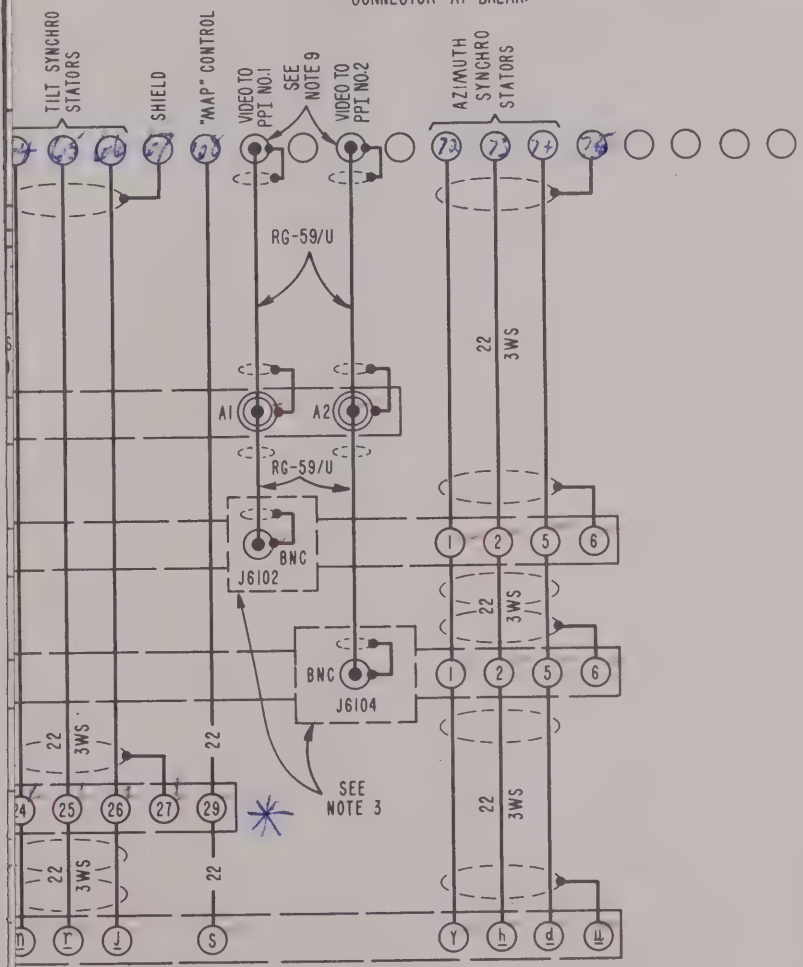


Figure 6-2. RDR-1 Airborne Radar System Interconnecting Wiring Diagram Modified for Single Phase A-C Input

TABLE 6-1. TEST EQUIPMENT REQUIRED--RDR-1 (C-band) AIRBORNE RADAR SYSTEM (cont)

Test Jig, SYN-1B (See note 3.)
Test Jig, ANT-1( ) (See note 4.)
Wedge, 10-degree slope

Notes:

1. See figure 6-3 for construction details.
2. Refer to Instruction Book I.B. 734, covering CON-1( ) Controls, for construction details.
3. Refer to Instruction Book I.B. 739, covering SYN-1B Synchronizer-Amplifier-Power Supply, for construction details.
4. Refer to Instruction Book I.B. 735, covering ANT-1( ) Antenna, for construction details.

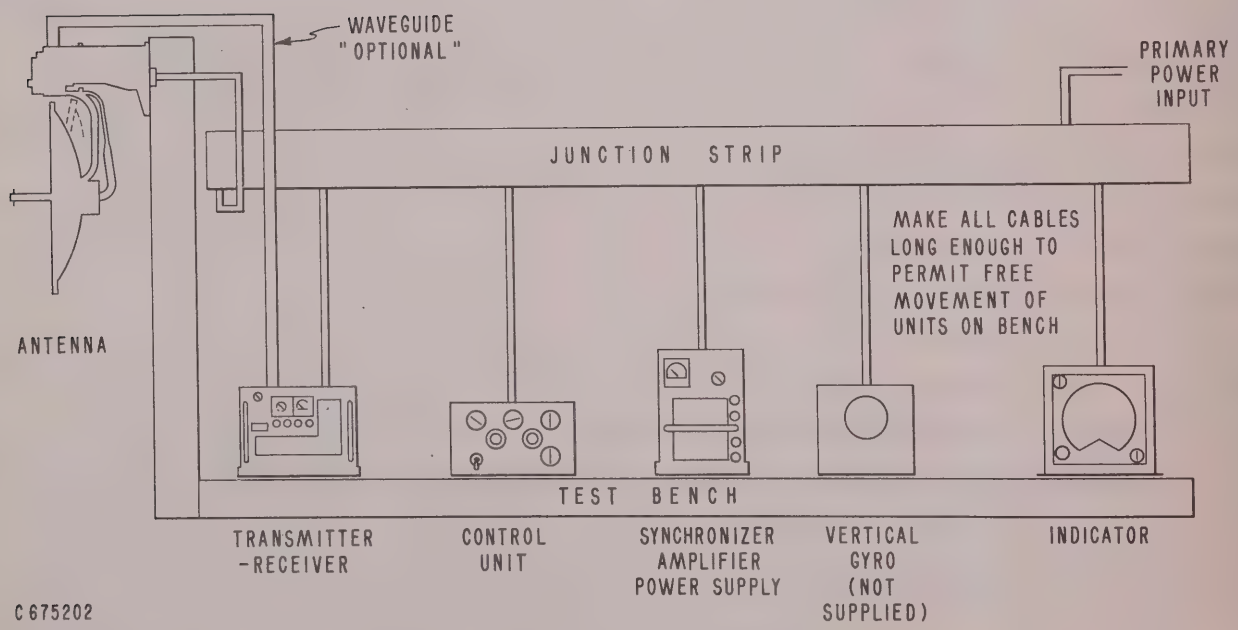
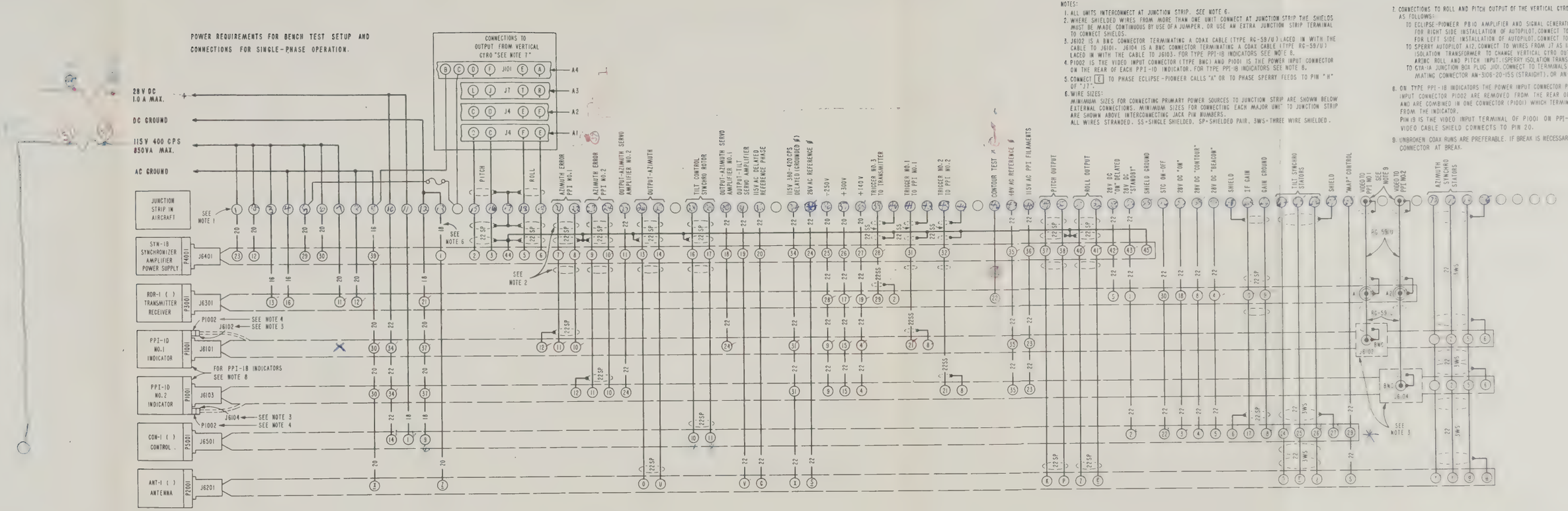


Figure 6-1. Test Bench Setup, RDR-1 Airborne Radar System (Suggested Layout), Block Diagram


POWER REQUIREMENTS FOR BENCH TEST SETUP AND CONNECTIONS FOR SINGLE-PHASE OPERATION.
28 V DC 1.0 A MAX.
DC GROUND
115 V 400 CPS 850VA MAX.
AC GROUND
CONNECTIONS TO OUTPUT FROM VERTICAL GYRO "SEE NOTE 7"
JUNCTION STRIP IN AIRCRAFT
SYN-1B SYNCHRONIZER AMPLIFIER POWER SUPPLY
RDR-1 ( ) TRANSMITTER RECEIVER
PPI-1D NO.1 INDICATOR
PPI-1D NO.2 INDICATOR
CON-1 ( ) CONTROL
ANT-1 ( ) ANTENNA
P675203

NOTES:

1. ALL UNITS INTERCONNECT AT JUNCTION STRIP. SEE NOTE 6.
2. WHERE SHIELDED WIRES FROM MORE THAN ONE UNIT CONNECT AT JUNCTION STRIP THE SHIELDS MUST BE MADE CONTINUOUS BY USE OF A JUMPER, OR USE AN EXTRA JUNCTION STRIP TERMINAL TO CONNECT SHIELDS.
3. J6102 IS A BNC CONNECTOR TERMINATING A COAX CABLE (TYPE RG-59/U) LACED IN WITH THE CABLE TO J6101. J6104 IS A BNC CONNECTOR TERMINATING A COAX CABLE (TYPE RG-59/U) LACED IN WITH THE CABLE TO J6103. FOR TYPE PPI-1B INDICATORS SEE NOTE 8.
4. P1002 IS THE VIDEO INPUT CONNECTOR (TYPE BNC) AND P1001 IS THE POWER INPUT CONNECTOR ON THE REAR OF EACH PPI-1D INDICATOR. FOR TYPE PPI-1B INDICATORS SEE NOTE 8.
5. CONNECT [E] TO PHASE ECLIPSE-PIONEER CALLS "A" OR TO PHASE SPERRY FEEDS TO PIN "H" OF J17.
6. WIRE SIZES:
   MINIMUM SIZES FOR CONNECTING PRIMARY POWER SOURCES TO JUNCTION STRIP ARE SHOWN BELOW EXTERNAL CONNECTIONS. MINIMUM SIZES FOR CONNECTING EACH MAJOR UNIT TO JUNCTION STRIP ARE SHOWN ABOVE INTERCONNECTING JACK PIN NUMBERS.
   ALL WIRES STRANDED. SS-SINGLE SHIELDED. SP-SHIELDED PAIR. 3WS-THREE WIRE SHIELDED.
7. CONNECTIONS TO ROLL AND PITCH OUTPUT OF THE VERTICAL GYRO MUST BE MADE AS FOLLOWS:
   TO ECLIPSE-PIONEER PB10 AMPLIFIER AND SIGNAL GENERATOR PLUG J4:
   FOR RIGHT SIDE INSTALLATION OF AUTOPILOT, CONNECT TO TERMINALS AS IN "A1".
   FOR LEFT SIDE INSTALLATION OF AUTOPILOT, CONNECT TO TERMINALS AS IN "A2".
   TO SPERRY AUTOPILOT A12, CONNECT TO WIRES FROM J7 AS IN "A3" USING PROPER ISOLATION TRANSFORMER TO CHANGE VERTICAL GYRO OUTPUT TO STANDARD ARINC ROLL AND PITCH INPUT. (SPERRY ISOLATION TRANSFORMER NO.69711)
   TO CTA-1A JUNCTION BOX PLUG J101, CONNECT TO TERMINALS AS IN "A4"; USE MATING CONNECTOR AN-3106-20-15S (STRAIGHT), OR AN-3108A-20-15S (ANGLE).
8. ON TYPE PPI-1B INDICATORS THE POWER INPUT CONNECTOR P1001 AND THE VIDEO INPUT CONNECTOR P1002 ARE REMOVED FROM THE REAR OF THE INDICATOR CHASSIS AND ARE COMBINED IN ONE CONNECTOR (P1001) WHICH TERMINATES A PENDANT CABLE FROM THE INDICATOR.
   PIN 19 IS THE VIDEO INPUT TERMINAL OF P1001 ON PPI-1B INDICATORS; THE VIDEO CABLE SHIELD CONNECTS TO PIN 20.
9. UNBROKEN COAX RUNS ARE PREFERRABLE. IF BREAK IS NECESSARY USE TYPE BNC CONNECTOR AT BREAK.

Figure 6-2. RDR-1 Airborne Radar System Interconnecting Wiring Diagram Modified for Single Phase A-C Input

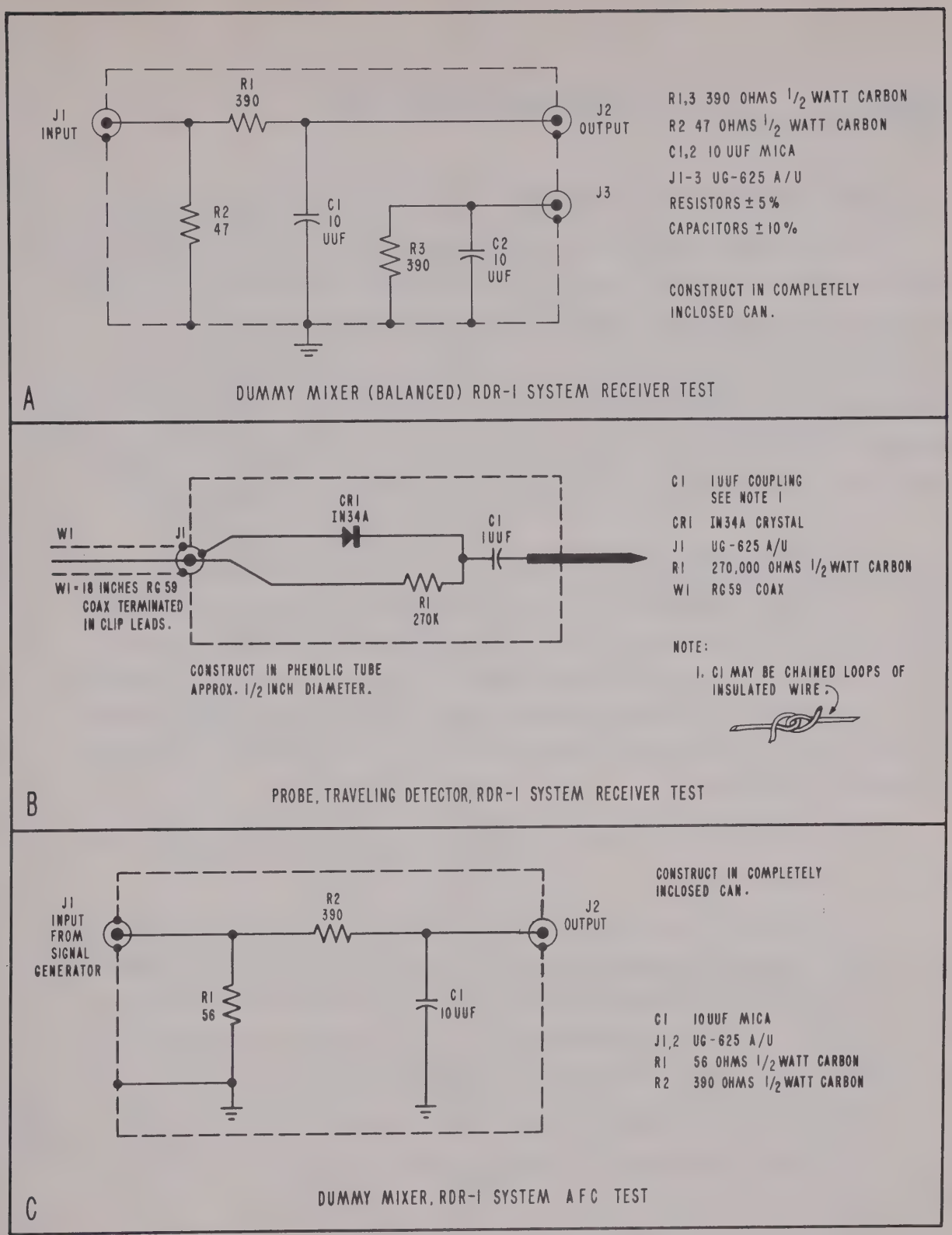


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Figure 6-3. Auxiliary Test Equipment Construction Data and Schematic Diagrams

6-4. BENCH TEST SETUP.

a. CABLING.--Figure 6-1 is a line diagram showing the relative positions of the five major units of the radar system, the junction strip where all unit interconnections are made, a vertical gyro, and the interconnecting cables.

Cables between the junction strip and each unit should be long enough to permit free movement of the units on the test bench and should allow room for test equipment on the bench between units. The system hook-up should be made in accordance with the modified system-interconnecting wiring diagram, figure 6-2.

b. INPUT POWER REQUIREMENTS.--All a-c loads are combined, per figure 6-2, so that a single-phase source of 115 volts ±5 per cent, 380-420 cps, at approximately 10 amperes, will be the only primary a-c power required. It is essential that the input ac is adjusted to 115 volts for all testing. If a variac is used for this purpose, care should be exercised to make certain that the ground side of the primary ac is checked through the variac and is applied to the system as indicated in figure 6-2.

Primary d-c power requirements are: 28 volts dc ±10 per cent, at a maximum of one ampere.

Roll and pitch output voltages from a vertical gyro are required for system testing and servo system alignment. These voltages must be 50 millivolts per degree of roll and pitch at +10 degrees to the phase of the reference voltage feeding the gyro. A stabilization data generator, type GYA-1A, as illustrated in the system instruction book, will satisfy this requirement.

The stabilization data generator must be mounted in such a manner that its vertical axis can be physically displaced up to ±10 degrees in both the roll and pitch axis.

6-5. TEST PROCEDURE, MODULATOR-TRANSMITTER SECTION OF RDR-1C TRANSMITTER-RECEIVER.

a. TEST EQUIPMENT REQUIRED.

Power Bridge, PRD 650-B		(Hewlett-Packard 430-C
Bolometer Mount with a 100-ma bolometer, PRD 628-A	or	(Hewlett-Packard 477-A Thermister Mount with W.E. 32A3 Thermister
Coax Attenuator, PRD 130C, calibrated at 5400 mc		(Coax Attenuator, Weinschel 210-20 (20-db attenuation)
RT Unit Adaptor, Bendix C244177-1		
Waveguide, H-plane 90-degree bend, type ARA-136, Airtron 67367	or	(Dummy load, Airtron high-power C-band double-ridge waveguide termination, Airtron
Impedance matching coupler, transition double-ridge to standard C-band waveguide, Airtron, type ARA-136		
Dummy load, C-band waveguide termination, Airtron 52152		

Test Set, Hewlett-Packard 618-B

Oscilloscope, Tektronix 531 with high-impedance probe

Echo Box, C-band, Narda, Model 833

Variac, General Radio, type V-10-HMT

Volt-ohmmeter, Triplett 630

Schematic Diagram, Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, figure 9-1. (Drawing No. OR669785.)

b. CONTINUITY TEST.--Before connecting the RDR-1C Transmitter-Receiver to any source of power or to the system test setup, make the following continuity tests.

NOTE

The receiver-afc chassis must be removed from the main chassis for this test. (See figure 6-6 for location of chassis and mounting hardware.)

CAUTION

Operation of the RDR-1C transmitter when the crystal diodes, in the duplexer-mixer assembly, are not properly terminated may result in damage to the diodes and a resultant decrease in receiver sensitivity. The output of the crystal diodes is normally connected to the receiver-afc chassis where proper termination is provided. However, should the receiver-afc chassis be disconnected, the crystal diodes should each be terminated with a 100-ohm resistive load prior to operation of the transmitter.

The RDR-1C Transmitter-Receiver employs two 1N23CR and one 1N23C crystal diodes; CR3005, CR3006, and CR3004, respectively. The output of these diodes being connected, via coaxial cable, to the receiver-afc chassis.

The 100-ohm termination resistors used may be built into BNC type fittings for ease of connection to the crystal diode outputs on the duplexer-mixer assembly.

FROM		TO		
CONNECTOR	TERMINAL	CONNECTOR	TERMINAL	READ ON OHMMETER
P3001	1	Ground		345 ohms ±10%
	2	Ground		Short
	4	Ground		Open
	5	Ground		145 ohms ±10%
	6	P3001	12	50 ohms ±5%
	6	Ground		Open
	7	Ground		Open
	8	P3006	4	Short
	8	Ground		Open

FROM CONNECTOR	TERMINAL	TO CONNECTOR	TERMINAL	READ ON OHMMETER
P3001	9	P3006	7	Short
	9	Ground		Open
	10	P3006	6	Short
	10	Ground		Open
	11	Ground		Open
	13	Ground		Open
	14	Ground		Open
	15	Ground		Open
	16	Ground		Open
	17	P3001	27	Short
	17	P3006	13	Short
	17	Ground		Open
	18	Ground		Open
	19	P3006	14	Short
	19	Ground		Open
	21	P3006	21	Short
	21	Ground		Open
	22	P3006	8	Short
	22	Ground		Open
	28	P3006	9	Short
	28	Ground		280K ohms ±20%
	29	P3006	17	Short
	29	P3001	2	Open
	29	Ground		Open

c. PRELIMINARY TESTS.--For the following preliminary tests, the receiver-afc chassis need not be reinstalled in the main chassis; however, the three crystal diodes in the duplexer-mixer assembly must be terminated. (Refer to CAUTION notice in paragraph 6-5b.)

Before connecting the RDR-1C Transmitter-Receiver into the test setup, establish the following initial control settings and, thereafter, use the controls on the CON-1A Control to energize the system as required.

UNIT	CONTROL	SETTING
CON-1A	OFF-STBY-ON switch	OFF
	ANT-TILT knob	ZERO-DEGREES
	GAIN knob	Counterclockwise
	DIMMER knob	Any
	CONTOUR-OFF switch	OFF
PPI-1( )	RANGE & MARKS switch	Any
	DIMMER knob	Any
	BRILLIANCE knob	Counterclockwise
SYN-1B	METER CIRCUIT SELECTOR switch	+300V
RDR-1C	METER CIRCUIT SELECTOR switch	MAG
ANT-1( )	AZ motor switch	OFF
	EL motor switch	OFF

NOTE

Vertical gyro is not needed for RDR-1C testing. It can be unplugged from system until needed.

Do not connect transmitter output to antenna.

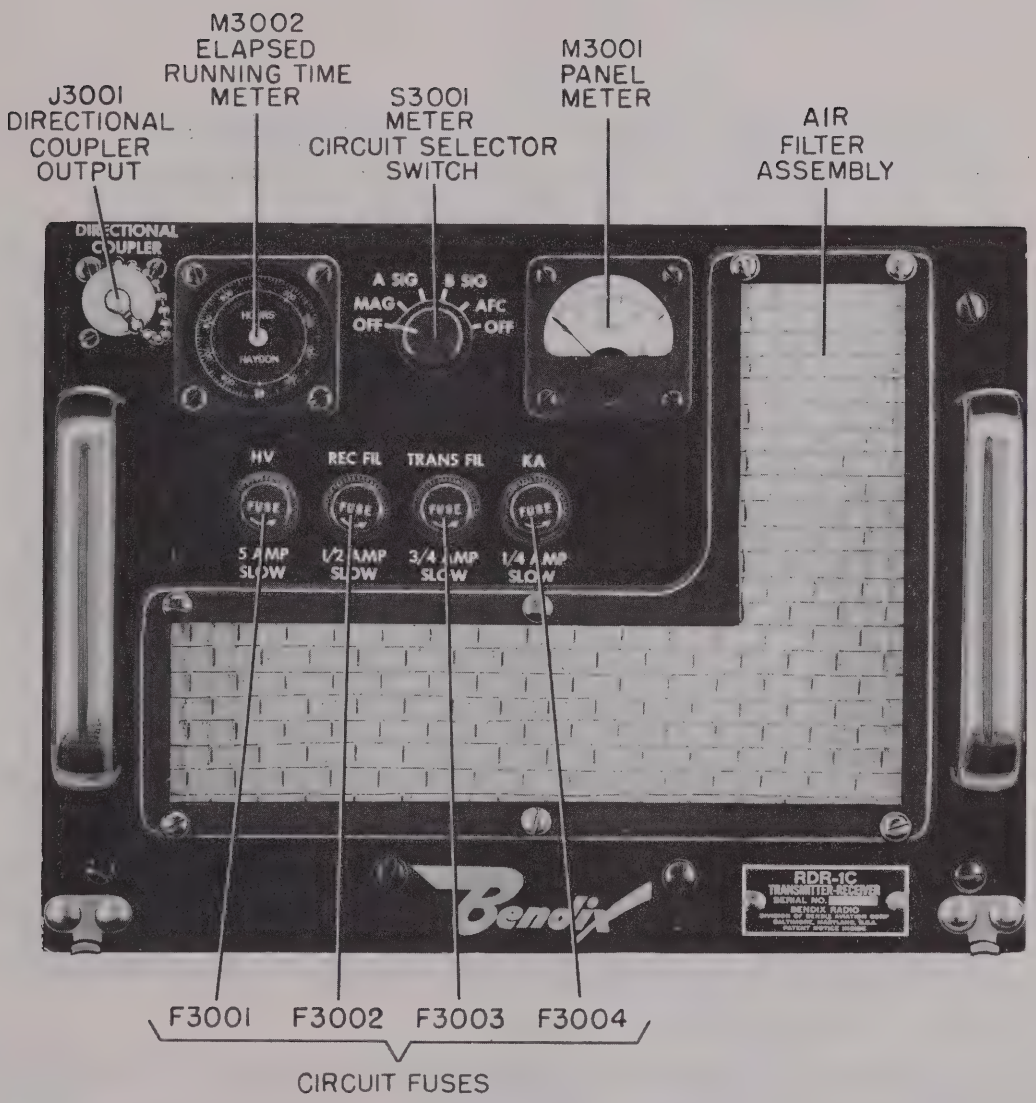


Figure 6-4. Front Panel of RDR-1C Transmitter-Receiver

Primary power to test setup should be checked and adjusted to:

115 volts, 380-420 cps
28 volts dc ±10 per cent

WARNING

Voltages exist in this equipment which are dangerous to life. Safe practices should be employed at all times. Pulse-forming networks should be shorted (discharged) before any work is done on or near them.

Remove "HV" (high voltage) fuse F3001 from the front panel of the RDR-1C Transmitter-Receiver. (See figure 6-4.) This will prevent the development of transmitter high voltage which is not required for preliminary tests.

(1) THERMAL RELAY DELAY TIME.--Thermal time delay relay K3001 (figure 6-7) should operate to its closed position in 180 ±20 seconds after the equipment is placed in STANDBY attitude. Test and adjustment procedure is as follows:

Step 1. Place system in "STANDBY" attitude and note exact time.

Step 2. One minute after performing step 1, place system in "ON" attitude. Note the elapsed time, in seconds, before thermal time delay relay K3001 closes as indicated by high voltage relay K3003 and magnetron filament control relay K3005 (figure 6-7) becoming energized. Measure time from instant system was placed in "STANDBY" attitude in step 1.

Step 3. If closing time is less than 160 seconds or more than 200 seconds, adjust screw on top of relay K3001 clockwise to decrease closing time, counterclockwise to increase closing time. (See note on next page.)

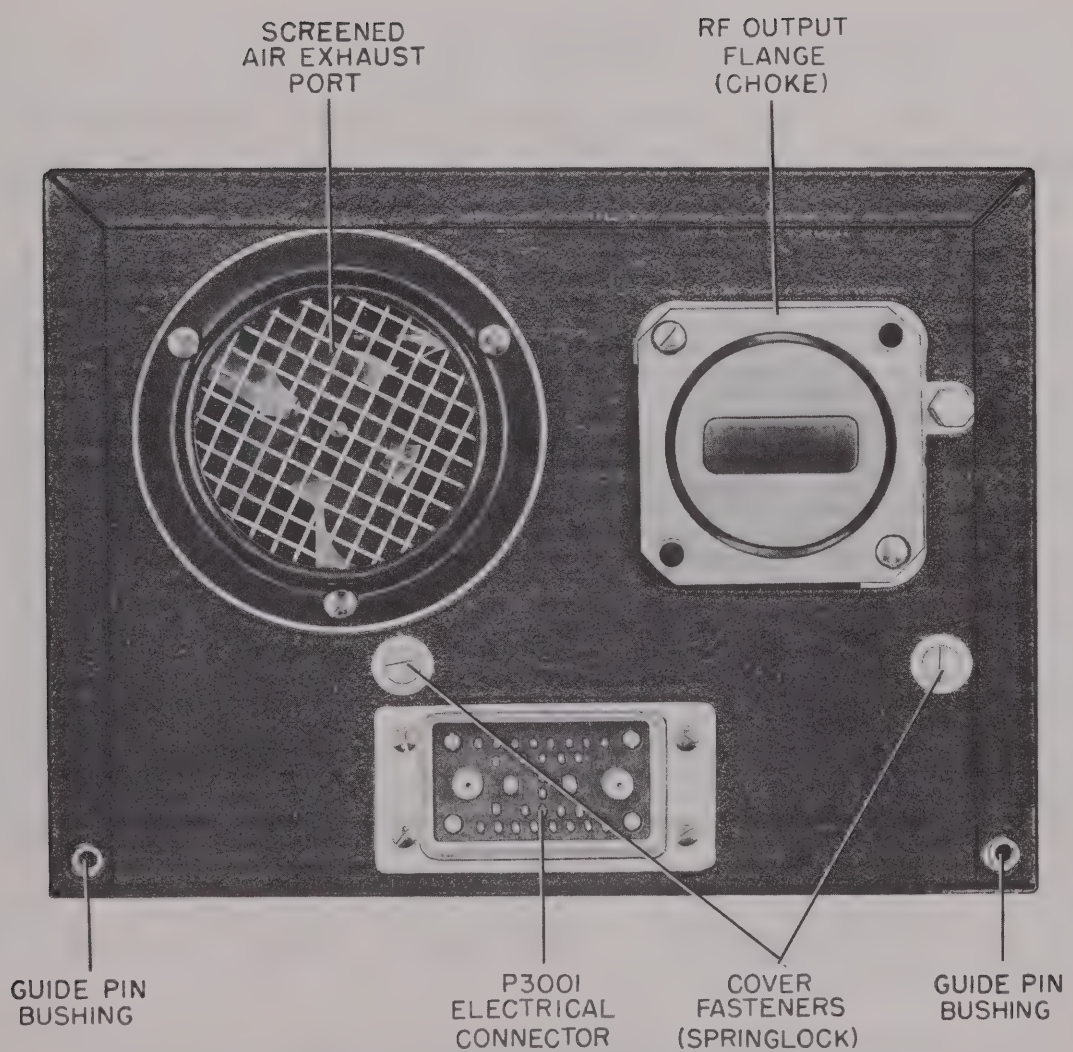


Figure 6-5. Rear View of RDR-1C Transmitter-Receiver

NOTE

Before making any adjustment to relay K3001, turn system "OFF" for at least ten minutes. System must be turned "OFF" for ten minutes or more between each adjustment to allow enough cooling time for the thermal element to return to its normal open position.

(2) BLOWER MOTOR OPERATION TEST.

Step 1. Place system in "STANDBY" attitude. Check to see that unit ventilating fan B3001 (figure 6-7) is exhausting air from the chassis and is operating at normal speed without excessive noise.

Step 2. Note that magnetron blower B3002 is not operating.

Step 3. Check that running-time meter M3002 (figure 6-4) is operating.

Step 4. Wait at least three minutes after performing step 1 and place system in "ON" attitude. Note that magnetron blower B3002 becomes energized and operates at normal speed without excess noise.

(3) MAGNETRON FILAMENT VOLTAGE TEST. [Note that "HV" fuse F3001 (figure 6-4) must be removed for the following steps.]

Step 1. Place system in "STANDBY" attitude.

Step 2. Measure magnetron filament voltage across capacitor C3003 (figure 6-8). Voltage must read between 6.0 and 6.6 volts ac.

Step 3. Place system in "ON" attitude. Thermal time delay relay K3001 must close before performing step 4.

Step 4. Measure magnetron filament voltage across capacitor C3003. Voltage must read between 2.9 and 3.7 volts ac. Note that magnetron blower B3002 operates.

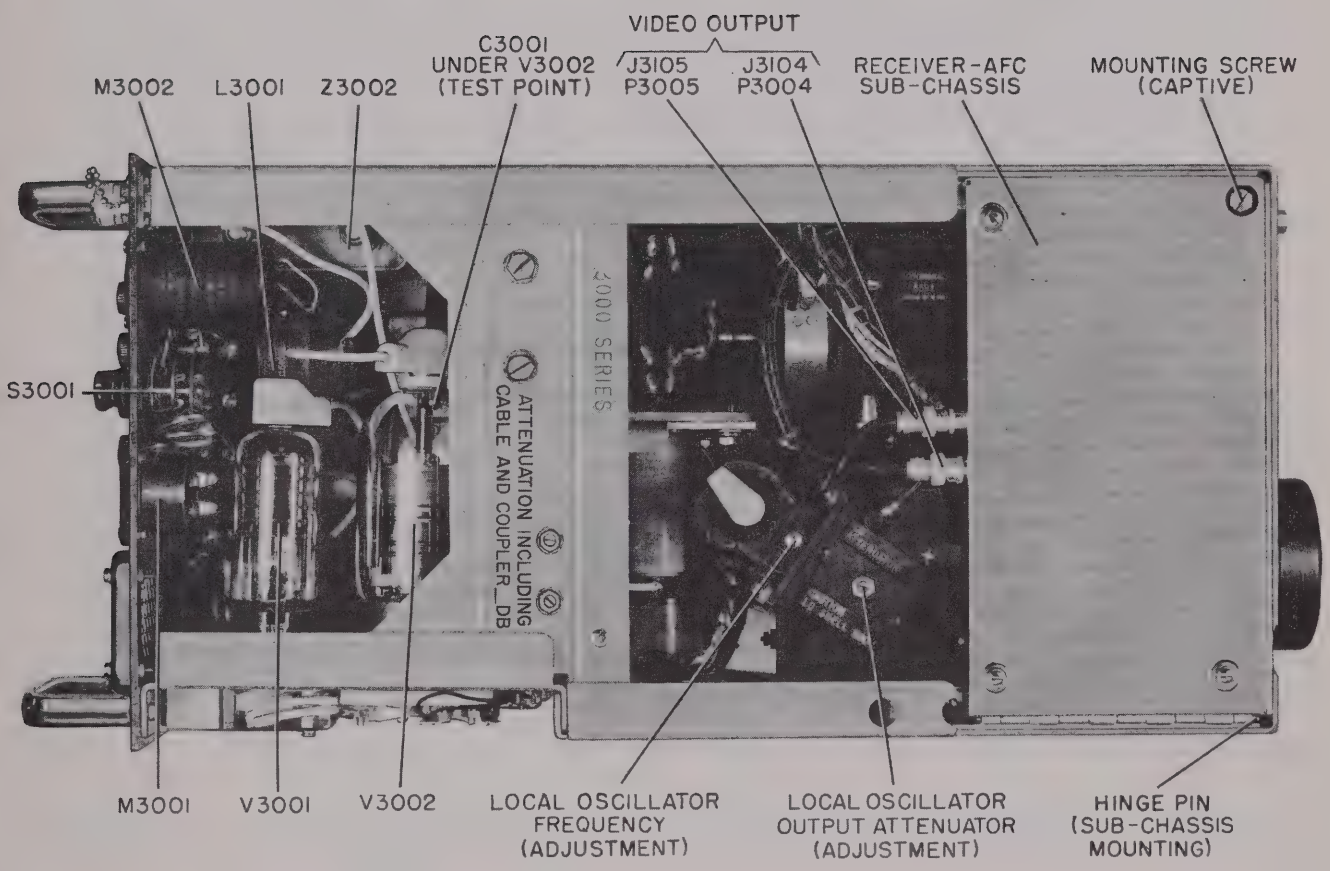


Figure 6-6. Top View of RDR-1C Transmitter-Receiver Chassis With Receiver-Afc Subchassis In Place

NOTE

Test 4 above also checks the operation of magnetron filament control relay K3005 (figure 6-8).

(4) KEEP-ALIVE VOLTAGE SUPPLY TEST.

Step 1. Place system in "STANDBY" attitude.

Step 2. Using volt-ohmmeter on 1200-volt d-c scale, measure keep-alive voltage at junction of resistor R3001 and capacitor C3002 (figure 6-7). Voltage must read between -600 and -750 volts dc.

(5) TRANSMITTER TRIGGER TEST.

Step 1. Connect oscilloscope (direct) to the grid, pin 1, of switch tube V3002 (B, figure 6-9).

Step 2. Place system in "ON" attitude.

Step 3. Synchronize oscilloscope with trigger monitor (test jack J4081 on front panel of SYN-1B Synchronizer-Amplifier-Power Supply).

Step 4. Check that trigger pulse is of sufficient amplitude to fire switch tube V3002 (figure 6-6) between cathode and grid (note glow inside V3002). This is also indicated on the oscilloscope by a spike on the leading edge of the trigger pulse followed by a pedestal of approximately 15 to 30 volts amplitude. Note that the width of the pulse is approximately four microseconds, that the trigger is stable, and that the baseline is open beneath the trigger pulse. (See waveshape in figure 6-9.)

Step 5. Turn system "OFF". Disconnect oscilloscope.

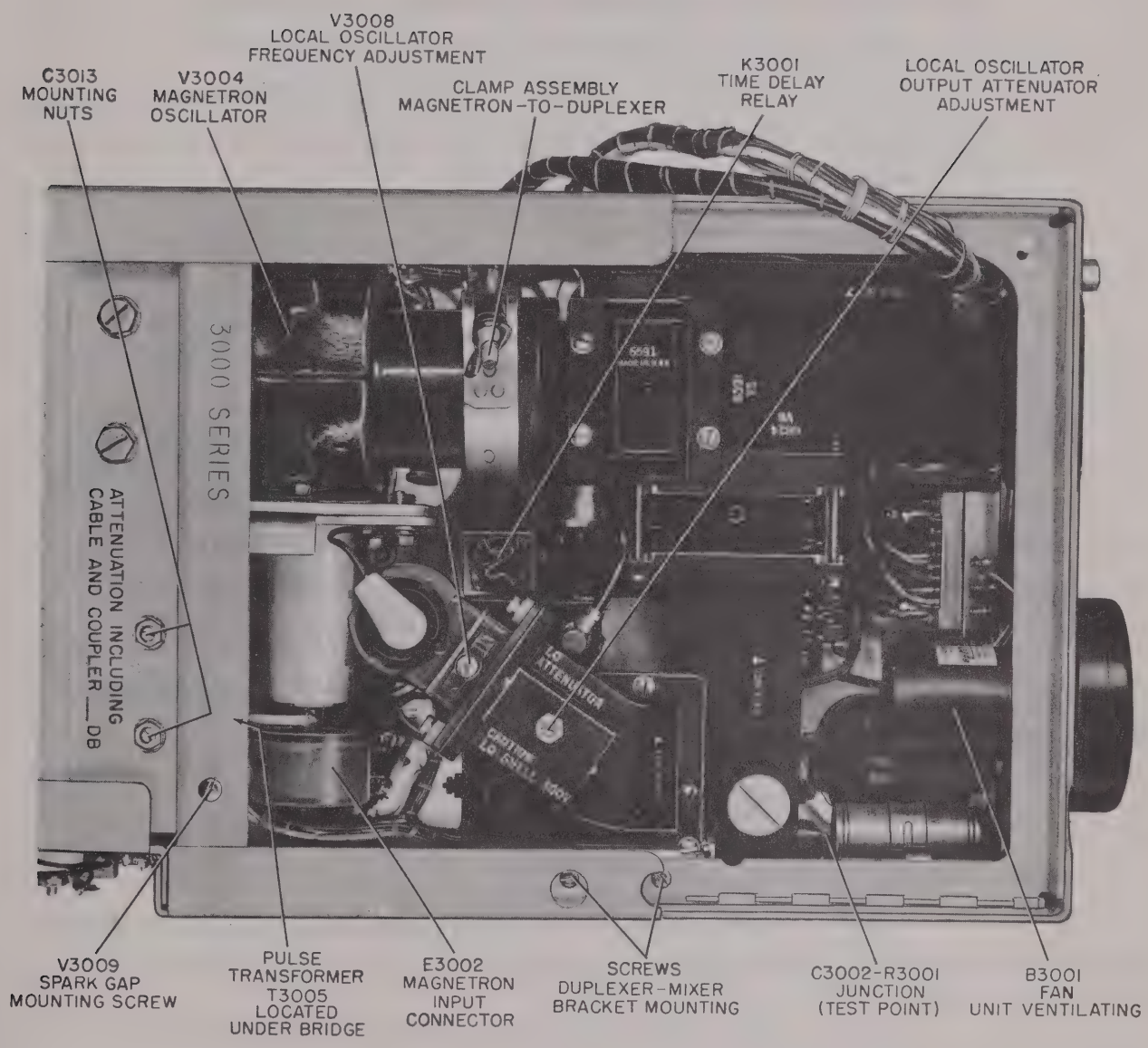


Figure 6-7. Top View, Rear Section of RDR-1C Transmitter-Receiver Chassis, Receiver-Afc Subchassis Removed

d. OPERATING TESTS.

WARNING

Operating tests require full power operation of the transmitter. Voltages which are dangerous to life are present in the equipment. Safe practices should be employed at all times. Pulse-forming networks should be shorted (discharged) before performing any work on or near them.

(1) PREPARATION.

Step 1. Terminate transmitter r-f output with dummy load. First connect an impedance-matching coupler (transition from double-ridge to standard C-band waveguide) to dummy load (C-band waveguide termination). Then connect a 90-degree H-bend double-ridge waveguide section to impedance-matching coupler. Then connect RT unit adaptor to H-plane bend section. The above combination, or the Airtron double-ridge waveguide termination (dummy load), can then be used as the transmitter termination by connecting either one to the r-f output flange on transmitter. The transmitter must be so terminated for all operating tests.

Step 2. Check that meter circuit selector switch S3001 (figure 6-4) is still in "MAG" position.

Step 3. Replace "HV" fuse F3001 (figure 6-4).

(2) MAGNETRON CURRENT TEST.

Step 1. Place system in "STANDBY" attitude. Wait three minutes until thermal time delay relay K3001 closes and then place system in "ON" attitude.

Step 2. Check magnetron current on panel meter M3001 (figure 6-4). Meter indication must be between 0.5 and 0.7 of full scale.

Step 3. Turn system "OFF."

(3) TRANSMITTER HIGH VOLTAGE TEST.

Step 1. Discharge pulse-forming network Z3002 (figure 6-9).

Step 2. Set volt-ohmmeter to 6000-volt d-c range and connect between capacitor C3001 terminal (figure 6-6) and chassis.

Step 3. Turn system "ON" and wait, approximately three minutes, until high voltage relay K3003 (figure 6-8) closes. Then read value of high voltage on volt-ohmmeter. Transmitter high voltage must be between 3300 and 3700 volts dc.

Step 4. Turn system "OFF." Discharge pulse-forming network Z3002. Disconnect volt-ohmmeter.

(4) OVERLOAD PROTECTION TEST.

Step 1. Ground the magnetron cathode. This is most easily done by connecting a short clip lead from the connection marked "C" on the magnetron plug E3002 (A, figure 6-7) to chassis ground.

Step 2. Turn system "ON."

Step 3. Note when high voltage comes on (observe ionization of switch tube V3002), that relays K3004 and K3003 (figure 6-8) chatter at approximately a two-cycle-per-second rate.

Step 4. Turn system "OFF" and discharge pulse-forming network Z3002.

Step 5. Remove ground from magnetron cathode as applied in step 1.

(5) CORONA DISCHARGE TEST.

Step 1. Remove "HV" from fuse F3001 (figure 6-4).

Step 2. Turn system "ON."

Step 3. Allow transmitter to operate for about one minute after relays K3003 and K3005 are activated and then reinstall "HV" fuse F3001.

Check that a spark discharge occurs only across the spark gap in the electrical surge arrester (tube V3009, figure 6-7) and that no arcing occurs at pulse transformer T3005 (figure 6-7).

Allow unit to clear trouble by itself. This should occur within 30 seconds.

Step 4. Turn system "OFF."

(6) TRANSMITTER PULSE WIDTH TEST.

Step 1. Turn system "ON." Allow at least three minutes for system to stabilize while performing steps 2 and 3.

Step 2. Synchronize oscilloscope to test trigger jack J4081 on front of SYN-1B Synchronizer-Amplifier-Power Supply.

Step 3. Connect a cable having a pickup probe at its free end to the oscilloscope "Y" axis input and bring probe within approximately two inches of magnetron plug E3002 (figure 6-7).

Step 4. Using the calibrated sweep of the oscilloscope, measure the width of the pulse being applied to the magnetron. The width of this pulse should be 2.0 ±0.25 microseconds.

Step 5. Turn system "OFF."

(7) TRANSMITTER OUTPUT POWER MEASUREMENT.--The following procedure is based on the use of a PRD 650-B Power Bridge, a PRD 628-A Bolometer Mount with a 100-milliampere bolometer, and a PRD 130-C Coax Attenuator calibrated at 5400 megacycles. If a different test set is used for this measurement, follow the test-set manufacturer's instructions.

NOTE

In order to avoid momentary overloads which might burn out the bolometer mount, the following sequence must be followed to calibrate the test equipment, and complete the power measurement.

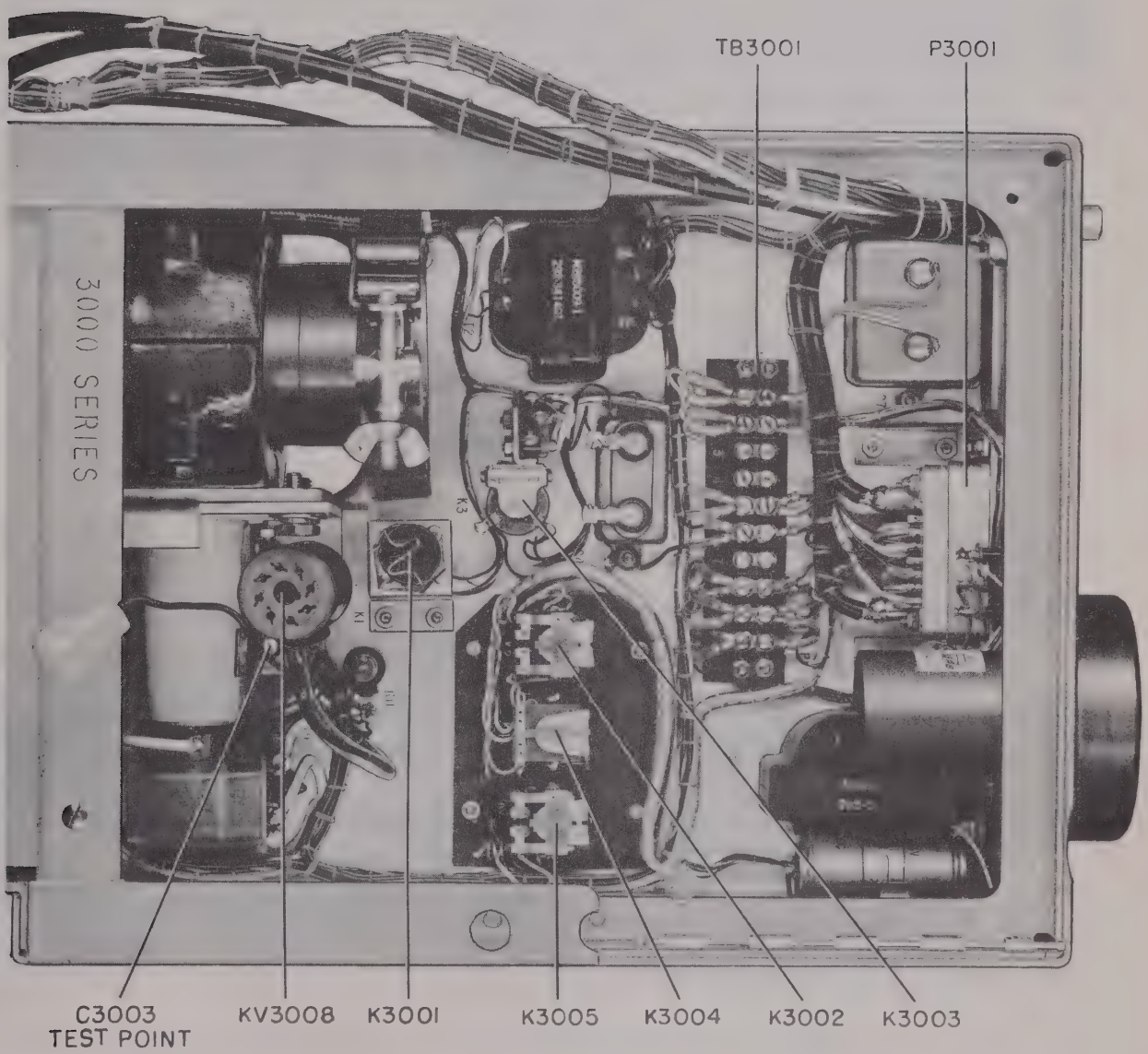


Figure 6-8. Top View, Rear Section of RDR-1C Transmitter-Receiver Chassis, Receiver-Afc Subchassis and Duplexer-Mixer Waveguide Assembly Removed

Step 1. Place system in "STANDBY" attitude and allow at least five minutes warm-up while calibrating and connecting test equipment.

Step 2. Set "BIAS CURRENT" control to "OFF"; "ZERO-SET" controls fully counterclockwise.

Step 3. Set "POWER RANGE SELECTOR" to "100."

Step 4. Set bolometer resistance "FIXED-ADJUST" switch, on the rear of the cabinet, to "FIXED."

Step 5. Set "BOLOMETER RESISTANCE" control to "200."

Step 6. Set "TEMPERATURE COEFFICIENT" switch to "+" (plus).

Step 7. Set "POWER" switch to "ON."

Step 8. Connect coax attenuator to bolometer mount.

Step 9. Connect bolometer mount to "INPUT" of test set.

Step 10. Set "BIAS CURRENT" switch to "11-40" range by depressing safety interlock button under the switch. Meter should swing off-scale to the left.

Step 11. Adjust the "ZERO-SET" controls until the meter reads exactly zero.

NOTE

The primary 400-cycle input source must be held to 115 volts while performing the balance of this procedure.

Step 12. Connect coax attenuator to directional coupler output jack J3001 on front panel of transmitter.

Step 13. After proper warm-up period (step 1) turn system "ON."

Step 14. Read power on appropriate scale of power meter. Make note of reading.

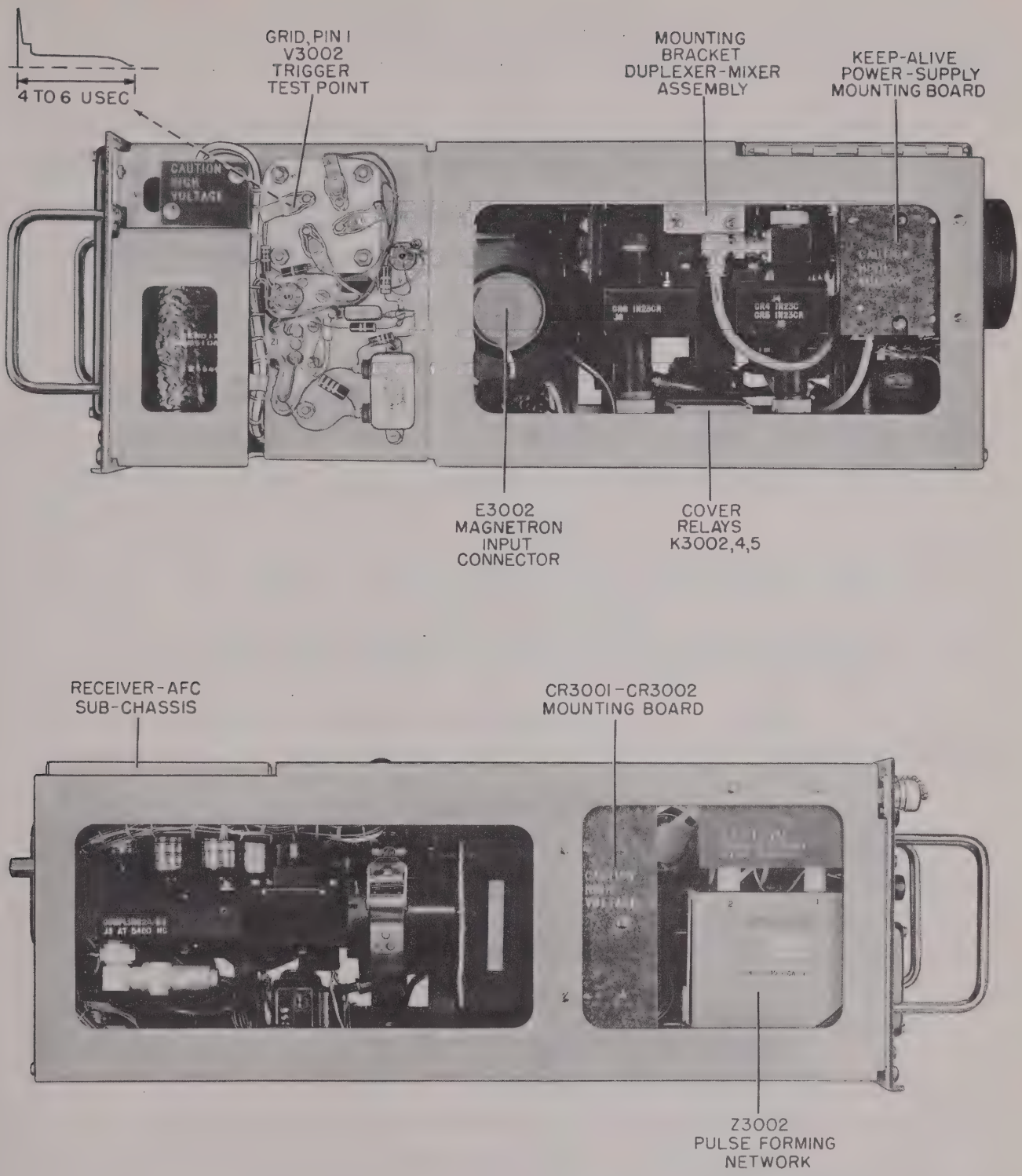


Figure 6-9. RDR-1C Transmitter-Receiver Chassis, (A) Right Side View, (B) Left Side View

Step 15. Place system in "STANDBY" and recheck zero adjustment. Repeat measurement if zero adjustment has drifted or changed; first reset zero.

Step 16. Turn system "OFF." DO NOT REMOVE BOLOMETER.

Step 17. Turn "ZERO-SET" controls fully counterclockwise. Set "BIAS CURRENT" to "OFF."

Step 18. Disconnect bolometer assembly from test set input, and coax attenuator from J3001 on transmitter.

Step 19. Turn test set "POWER" switch to "OFF."

NOTE

Failure to follow accurately the steps 1 through 19 above will result in burnout of the bolometer element. Do NOT slight any steps or attempt shortcuts in the above procedure.

Step 20. Convert reading obtained in step 14 to db-above-one-milliwatt as follows:

(Example only) Final reading is 6.3 milliwatts. This is a power ratio of 6.3 to 1. From db-power-ratio chart, a ratio of 6.3 to 1 equals 8 db. Add to this db figure the attenuation stamped on the PRD 130-C attenuator (9.7 db) and the directional coupler and cable attenuation figure stamped on the transmitter chassis (29.3 db). (See figure 6-7.) The sum of the above attenuations must equal or exceed 47 db, e.g.,

Power Bridge reading (converted to db)	8.0 db
Coax attenuator attenuation	9.7 db
Directional coupler and cable attenuation	29.3 db
Total attenuation	47.0 db

From db-power-ratio chart, 47.0 db equals a power ratio of 50,000 to 1. This represents an average output power of 50 watts. Average power divided by duty

cycle of transmitter (0.0008) equals peak power output; e.g., 50 ÷ 0.0008 = 62.5-kilowatt peak power, which is the minimum acceptable peak power output.

Step 25. Disconnect test equipment. Leave transmitter turned "ON" for transmitter output frequency measurement following.

(8) TRANSMITTER OUTPUT FREQUENCY MEASUREMENT.

Step 1. Connect echo box to directional coupler output test jack J3001 on front of operating transmitter.

Step 2. Tune echo box carefully for maximum meter reading. Read frequency indicated on echo box tuning dial. Frequency must fall between the limits of 5370 and 5430 megacycles.

Step 3. Turn transmitter "OFF." Disconnect test equipment.

e. SUMMARY OF MINIMUM PERFORMANCE STANDARDS, MODULATOR-TRANSMITTER SECTION.

TEST	SPECIFIED LIMITS OR REQUIREMENTS
Time Delay (relay K3001)	Delay time 180 ±20 seconds
Magnetron Filament Voltage	Stand-by: 6.0 to 6.6 volts ac On: 2.9 to 3.7 volts ac
Keep-Alive Voltage (at C3002)	-600 volts dc minimum -750 volts dc maximum
Transmitter Trigger:	
Amplitude:	Must fire V3002 between cathode and grid.
Width:	4.0 microseconds minimum
Magnetron Current:	0.5 to 0.7 of full scale on panel meter M3001
Transmitter High Voltage (at C3001)	3300 volts dc minimum 3700 volts dc maximum

TEST	SPECIFIED LIMITS OR REQUIREMENTS
Transmitter High Voltage Overload Protection:	Relays K3003 and K3004 chatter approximately two cycles per second on overload.
Corona Discharge:	No arcing except across spark gap of electrical surge suppressor tube V3009.
Transmitter Power Output:	47 dbm minimum
Transmitter Pulse Width:	2.0 ±0.25 microseconds
Transmitter Output Frequency:	5400 ±30 megacycles

6-6. TEST AND ALIGNMENT PROCEDURES, RECEIVER-AFC SECTION OF RDR-1B-1 TRANSMITTER-RECEIVER.

a. TEST EQUIPMENT REQUIRED.

Signal generator, Measurements Corp., Model 80 or Hewlett-Packard, Model 608D

Pulse generator, Measurements Corp., Model 79-B or Hewlett-Packard 212A

Oscilloscope, Tektronix, Model 531 with high-impedance bridge

Dummy mixer, receiver (A, figure 6-3)

Dummy mixer, afc (C, figure 6-3)

Probe, traveling detector (B, figure 6-3)

VTVM, Hewlett-Packard, Model 410B

Volt-ohmmeter, Triplett, Model 630

Sweep generator, Rada-Sweep

Receiver-afc circuit schematic diagram (figure 9-2) Drawing No. OR669788

b. CONTINUITY TEST.--With the receiver afc chassis completely disconnected from the transmitter main chassis, make the following continuity tests. All tubes must be in place.

FROM CONNECTOR	TERMINAL	TO CONNECTOR	TERMINAL	READ ON OHMMETER
J3103	1	W3101	Center	105 ohms ±10%
	1	Ground		Open
	4	Ground		440 ohms ±10%
	6	Ground		216K ohms ±20%
	6	J3103	9	100K ohms ±10%
	6	J3103	10	100K ohms ±10%
	6	J3103	11	100K ohms ±10%
	7	Ground		0/1K ohms
	8	J3102		1 megohm ±20%
	8	Ground		1 megohm ±20%
	9	Ground		116K ohms ±20%
	10	Ground		116K ohms ±20%
	12	Ground		Less than 1 ohm
	13	Ground		Open
	14	Ground		567K ohms ±10%
	15	W3102	Center	105 ohms ±10%
	15	Ground		Open
	16	Ground		Less than 1 ohm
	17	Ground		Open
	19	Ground		Short
	20	Ground		Short
	21	Ground		Short
	22	Ground		Short
	23	J3107		Short
	23	Ground		1 megohm ±20%
	25	Ground		Open
	25	W3103	Center	105 ohms ±10%

FROM CONNECTOR	TERMINAL	TO CONNECTOR	TERMINAL	READ ON OHMMETER
J3104		Ground		2.2K ohms ±10%
J3105		Ground		2.2K ohms ±10%
J3106		Ground		Open
J3101		Ground		57K ohms ±10%

c. STC CIRCUIT TEST AND ADJUSTMENT.--The receiver-afc chassis must be completely connected (electrically) to the transmitter main chassis during the STC circuit test and adjustment.

Figure 6-10 is a top view of the receiver-afc chassis with identification of all controls, connectors, test points, and adjustments.

Figure 6-11 is a bottom view of the receiver-afc chassis, cover removed, showing the location of the three major circuit sections contained on the chassis.

(1) STC PULSE AMPLITUDE TEST.

Step 1. Connect oscilloscope to test jack J3101 on receiver-afc chassis (figure 6-10) with probe. Ground oscilloscope to receiver-afc chassis.

Step 2. Remove "HV" fuse F3001 (figure 6-4) from transmitter front panel.

Step 3. Place system in "STANDBY" and wait at least three minutes, then turn system "ON."

Step 4. Synchronize oscilloscope with trigger at trigger-test jack J4081 on front panel of SYN-1B Synchronizer-Amplifier-Power Supply.

Step 5. Rotate STC depth adjusting potentiometer R3149 (figure 6-10) fully clockwise.

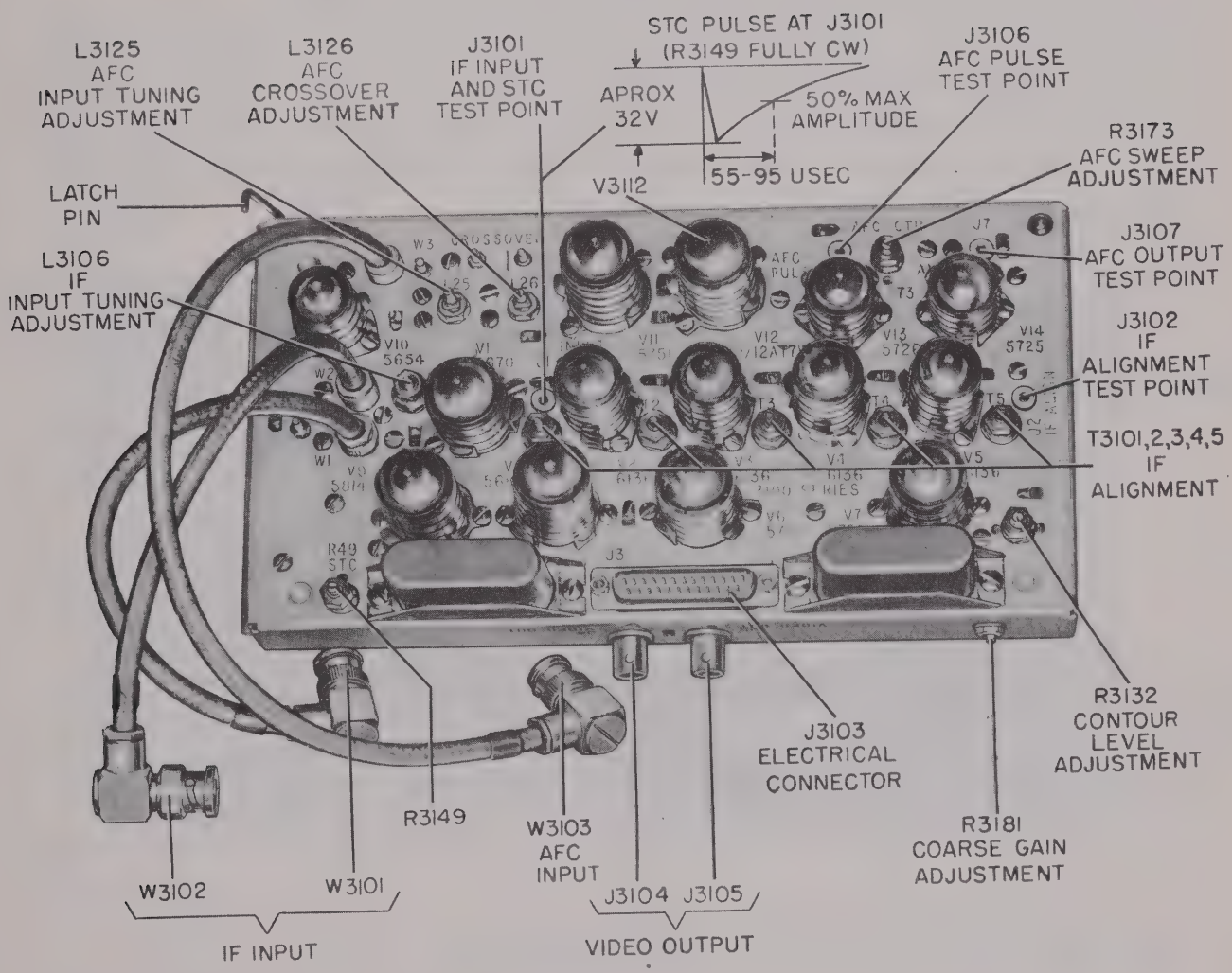


Figure 6-10. Top View of Receiver-Afc Subchassis, Part of RDR-1C Transmitter-Receiver

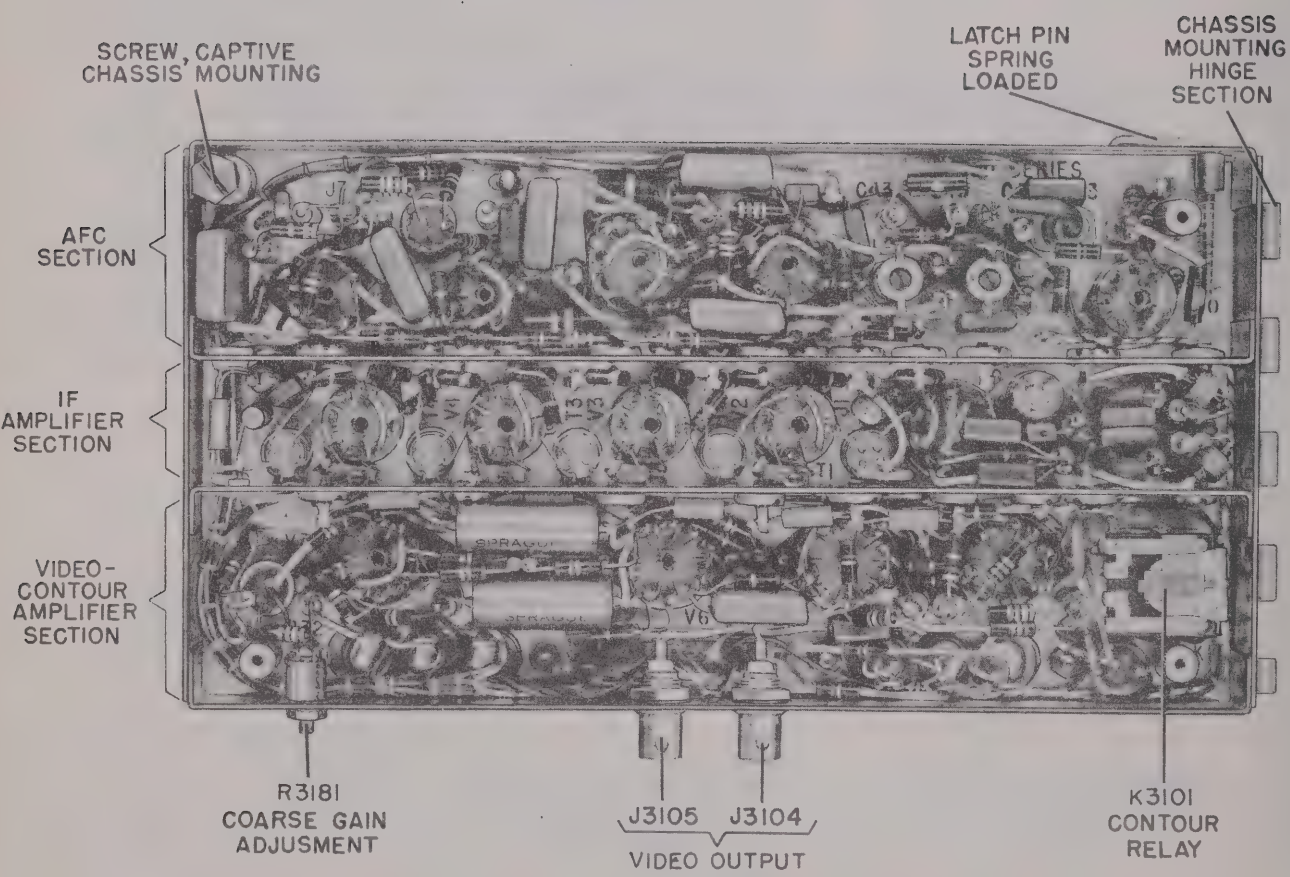


Figure 6-11. Bottom View of Receiver-Afc Subchassis, Part of RDR-1C Transmitter-Receiver

Step 6. Calibrate oscilloscope by means of its internal calibration and measure the peak-to-peak amplitude of the STC pulse at test jack J3101. Peak-to-peak pulse amplitude must be at least 20 volts.

(2) STC PULSE WIDTH TEST.

Step 7. Adjust oscilloscope for a 200-microsecond sweep with the STC pulse starting at the sweep origin. Measure the time interval from the leading edge of the pulse to the point at which the amplitude of the pulse is just one-half its maximum value. (See waveshape in figure 6-10.) Width of pulse from leading edge to half-amplitude point must be within the limits of 55 to 95 microseconds.

Step 8. Slowly turn the STC range adjusting potentiometer R3149 counterclockwise and observe the pulse on oscilloscope. It should decrease in amplitude to zero as the control is turned fully counterclockwise.

Step 9. Leave R3149 adjusted fully counterclockwise for the following procedures. Final STC adjustment follows in paragraph 6-7h.

Step 10. Turn system "OFF." Disconnect test equipment.

d. CASCODE IF, ALIGNMENT AND BANDPASS.

(1) ALIGNMENT.

Step 1. Disconnect cables W3101, W3102, and W3103 from the crystal output connectors on the duplexer-mixer assembly in the transmitter. These cables are attached to the receiver-afc chassis. (See figure 6-10.) Leave electrical connector J3103, on the receiver-afc chassis, connected to plug P3006 in the transmitter main chassis.

Step 2. Check that "HV" fuse F3001 is still removed from transmitter front panel.

Step 3. Connect signal generator to signal input jack J1 on dummy mixer (A, figure 6-3).

Step 4. Connect receiver input cable W3101 to dummy mixer output jack J2.

Step 5. Connect receiver input cable W3102 to dummy mixer output jack J3.

Step 6. Connect traveling detector probe (B, figure 6-3) between input test jack J3101 on receiver chassis (figure 6-10) and the oscilloscope "Y" axis input. Ground oscilloscope to receiver-afc chassis.

Step 7. Connect a d-c VTVM across the oscilloscope "Y" axis input.

Step 8. Place system in STANDBY attitude. Wait at least three minutes, then turn system "ON."

Step 9. Adjust signal generator for a 30-megacycle signal modulated 30 per cent at 400 cps.

Step 10. Adjust the oscilloscope "Y" axis gain and signal generator output to obtain a 30 per cent modulated 400-cycle signal of convenient size on oscilloscope, keeping amplitude as low as is convenient.

Step 11. Adjust i-f transformer T3101 (figure 6-10) for maximum gain at 30 megacycles, as indicated on VTVM. Observe oscilloscope display to see that no distortion occurs.

Step 12. Adjust inductor L3106 (figure 6-10) for peak response on VTVM at 30 megacycles as signal generator is shifted back and forth across this frequency.

Step 13. Repeat steps 11 and 12 until no further improvement is noted.

(2) BANDPASS (3 DB).

Step 14. Readjust oscilloscope "Y" axis gain, and signal generator output to 70,000 microvolts, to obtain an undistorted, modulated 400-cycle signal on oscilloscope. Check that signal is maximum at 30 megacycles as indicated on VTVM. Note amplitude of signal on oscilloscope.

Step 15. Increase signal generator output to 100,000 microvolts and increase frequency above 30 megacycles until the oscilloscope presentation falls off to the same amplitude as noted in step 14. Record this frequency as "high-side 3-db frequency."

Step 16. Decrease signal generator frequency below 30 megacycles until the oscilloscope presentation falls to the same amplitude noted in step 14. Record this frequency as "low-side 3-db frequency."

Step 17. Compute 3-db bandpass as follows: 3-db bandpass = "high-side 3-db frequency" minus "low-side 3-db frequency." The 3-db bandpass should be a minimum of 2.0 megacycles.

Step 18. Readjust signal generator to 30 megacycles and reverse connections to receiver input cables W3001 and W3002. This should cause no appreciable change in signal level as indicated on oscilloscope.

Step 19. Disconnect test equipment. Leave system turned "ON" for i-f strip alignment following.

e. I-F STRIP, ALIGNMENT AND OVER-ALL BANDPASS.

(1) ALIGNMENT.

Step 1. Connect receiver input cable W3001 to dummy mixer output jack J2.

Step 2. Connect receiver input cable W3102 to dummy mixer output jack J3.

Step 3. Connect oscilloscope "Y" axis input (direct) to i-f alignment test jack J3102 on receiver-afc chassis (figure 6-10). Ground oscilloscope to receiver-afc chassis.

Step 4. Connect a d-c VTVM across oscilloscope "Y" axis input.

Step 5. Adjust "COARSE GAIN" control R3181 on receiver-afc chassis fully clockwise (figure 6-10).

Step 6. Adjust "GAIN" control on CON-1A Control for 0.2 volt of noise as measured on VTVM at J3102.

Step 7. Disconnect VTVM.

Step 8. Connect output of signal generator to input jack J1 on dummy mixer.

Step 9. Connect output of pulse generator to pulse input of signal generator.

Step 10. Adjust pulse generator for a 400-pulse-rate frequency and a pulse width of 20 microseconds.

Step 11. Adjust signal generator for 30-megacycle signal and switch to "EXTERNAL PULSE."

Step 12. Increase signal generator output amplitude until receiver output, as observed on oscilloscope, ceases to increase (receiver reaches saturation). Make sure the oscilloscope is not saturating.

Step 13. Reduce signal generator output amplitude until oscilloscope indicates just one-third the receiver output obtained at saturation.

Step 14. Adjust i-f transformers T3101 through T3105 for maximum pulse indication on oscilloscope. Reduce input signal level as necessary to keep receiver output at about one-third saturation level.

Step 15. Adjust signal generator for 31-megacycle output.

Step 16. Adjust i-f transformer T3102 for maximum pulse indication on oscilloscope.

Step 17. Adjust signal generator for 29-megacycle output.

Step 18. Adjust i-f transformer T3103 for maximum pulse indication on oscilloscope.

Step 19. Adjust signal generator for 30-megacycle output.

Step 20. Readjust i-f transformers T3101, T3104, and T3105 for maximum pulse indication on oscilloscope.

NOTE

Steps 15 through 20 stagger tunes the i-f amplifier strip to expand over-all bandwidth.

Step 21. Disconnect signal generator from dummy mixer.

Step 22. Momentarily reconnect VTVM across oscilloscope "Y" axis input and readjust "GAIN" control, on CON-1A Control, for 0.2 volt of noise as read on VTVM. Disconnect VTVM. Reconnect signal generator to dummy mixer input.

Step 23. Tighten i-f transformer slug nuts, slightly, and repeat tuning procedure until no further increase in output can be obtained.

Step 24. Tighten i-f transformer slug nuts securely.

(2) OVER-ALL BANDPASS.

Step 25. Disconnect signal generator from dummy mixer.

Step 26. Reconnect VTVM across oscilloscope "Y" axis input.

Step 27. Readjust "GAIN" control on CON-1A Control for 0.2 volt of noise as read on VTVM. Disconnect VTVM.

Step 28. Reconnect signal generator to dummy mixer input.

Step 29. Adjust signal generator for 30-megacycle signal; pulse signal generator with 20-microsecond pulses at a 400-pulse-rate frequency.

Step 30. Adjust signal generator for a 70-microvolt output.

Step 31. Swing signal generator frequency back and forth to be sure the i-f strip is peaked at 30 megacycles. Observe the output pulse amplitude on oscilloscope at 30 megacycles.

Step 32. Increase signal generator output to 100 microvolts and increase frequency above 30 megacycles until the receiver output pulse amplitude falls to the level noted in step 31. Record signal generator frequency as "high-side 3-db frequency."

Step 33. Decrease signal generator output below 30 megacycles until the receiver output pulse amplitude falls to the level noted in step 31. Record signal generator frequency as "low-side 3-db frequency."

Step 34. Compute 3-db over-all bandpass as follows: "high-side 3-db frequency" minus "low-side 3-db frequency." Over-all 3-db bandpass must fall within the limits of 0.75 and 1.5 megacycle.

Step 35. Compute i-f center frequency as follows:

$$\text{cf.} = \frac{\text{"high-side 3-db frequency" plus "low-side 3-db frequency"}}{2}$$

Center frequency must be within the limits of 29.7 and 30.3 megacycles.

(3) GAIN TEST.

Step 36. Disconnect signal generator from dummy mixer.

Step 37. Disconnect oscilloscope from receiver test jack J3102.

Step 38. Connect VTVM between receiver test jack J3102 and chassis ground.

Step 39. Set "GAIN" control on CON-1A Control fully clockwise. Check that "COARSE GAIN" control is still set fully clockwise.

Step 40. Read noise output on VTVM. Noise output at receiver test jack J3102 must be minus 1.0 volt minimum.

Step 41. Disconnect VTVM. Leave system "ON" for following procedure.

f. CONTOUR CIRCUIT ADJUSTMENT.

Step 1. Connect oscilloscope to "VIDEO OUTPUT" jack J3104 or J3105 (figure 6-10); terminate oscilloscope cable with a 100-ohm noninductive resistor at oscilloscope end.

Step 2. Calibrate oscilloscope for one-volt-per-centimeter deflection.

Step 3. Connect output of pulse generator to pulse input of signal generator.

Step 4. Adjust pulse generator for a 400-pulse-rate frequency and a pulse width of 20 microseconds.

Step 5. Connect synchronizing output of pulse generator to trigger input of oscilloscope.

Step 6. Switch oscilloscope to "EXTERNAL PULSE."

Step 7. Connect receiver input cables W3101-W3102 to dummy mixer output jacks J2-J3.

Step 8. Check that "CONTOUR-OFF" switch, on CON-1A Control, is in "OFF" position; i-f "GAIN" control at midrange.

Step 9. Set "COARSE GAIN" control R3181, on receiver chassis, fully clockwise.

Step 10. With signal generator disconnected from dummy mixer input, adjust "GAIN" control, on CON-1A Control, until noise on oscilloscope reaches limit level. Note limit level amplitude.

Step 11. Adjust "GAIN" control, on CON-1A Control, counterclockwise until noise is reduced to just one-third of limit level as noted in step 10.

Step 12. Adjust signal generator for a 30-megacycle signal, pulsed as in step 4, and connect signal generator output to dummy mixer input jack J1.

Step 13. Adjust signal generator output to produce a minimum-discernible-signal (MDS) on oscilloscope. Note signal generator output required.

Step 14. Increase signal generator output to 5.62 times that noted in step 13 (approximately 15 db).

Step 15. Place "CONTOUR-OFF" switch, on CON-1A Control, in "CONTOUR" position (contour on).

Step 16. Adjust "CONTOUR LEVEL" potentiometer R3132 (figure 6-10) until noise just appears within the pulse. Tighten lock nut on R3132.

NOTE

The above procedure establishes the dynamic range of the contour circuit at a nominal 15 db. This means that all echo signals of amplitude in excess of 15 db above a MDS (minimum-discernible-signal) will be erased when contour circuit is in operation.

Step 17. Disconnect test equipment. Leave system "ON" for following procedure.

g. AFC SECTION ADJUSTMENT.

(1) DISCRIMINATOR.

Step 1. Connect the sweep output of the sweep generator to oscilloscope "Y" axis input.

Step 2. Connect the sweeping oscillator output of the sweep generator, and the signal generator output to the afc dummy mixer input jack J1 (C, figure 6-3), using a type UG-274A/U adaptor to combine the two input signals.

Step 3. Connect cable W3103 from afc chassis (figure 6-10) to output jack J2 on afc dummy mixer (C, figure 6-3).

Step 4. Connect oscilloscope "Y" axis input to pin 2 of pulse amplifier tube V3112 (figure 6-10) through high-impedance probe. Remove tube and make connection through top of tube socket. Leave chassis bottom cover on.

Step 5. Ground receiver-afc chassis to oscilloscope.

Step 6. Adjust sweep generator for a 30-megacycle center frequency with WIDE sweep and keep output as low as possible to prevent distortion.

Step 7. Adjust signal generator for a 30.2-megacycle cw output, keeping output level as low as possible and still provide a marker.

Step 8. Adjust afc input tuning inductor L3125 and afc crossover adjusting inductor L3126 (figure 6-10) for best "S" curve on oscilloscope with crossover at 30.2 megacycles.

NOTE

Adjust L3125 and L3126 alternately as necessary. Crossover is correct when "birdie" is minimized.

Step 9. Lock L3125 and L3126 adjustments and recheck, on oscilloscope, to see that adjustment has not changed.

Step 10. Disconnect sweep generator.

Step 11. Disconnect oscilloscope "Y" axis input from pin 2 of V3112 and connect oscilloscope "Y" axis input to afc output test jack J3107 through high-impedance probe.

Step 12. Replace pulse amplifier tube V3112.

Step 13. Connect output of pulse generator to pulse input of signal generator.

Step 14. Adjust pulse generator for a 400-pulse-rate frequency with a 20-microsecond pulse width.

Step 15. Set signal generator for "EXTERNAL PULSE" and adjust for a 30.2-megacycle signal with 100,000-microvolt output.

Step 16. Slowly reduce signal generator frequency until sweep generator (phantastron) tube V3114 stops sweeping as evidenced on oscilloscope. The frequency required to stop V3114 sweep must fall within the limits of 29.6 and 30.1 megacycles.

(2) PULSE AMPLIFIER TEST.

Step 17. Adjust signal generator frequency to 29 megacycles and reduce output to 70,000 microvolts.

Step 18. Move oscilloscope "Y" axis input from afc output test jack J3107 to afc pulse test jack J3106.

Step 19. Use the internal calibrating facilities of oscilloscope and measure the pulse amplitude at J3106. Pulse amplitude must exceed 10 volts. Take probe attenuation into consideration.

(3) SWEEP GENERATOR (PHANTASTRON) CIRCUIT TEST.

Step 20. Move the oscilloscope "Y" axis input from afc pulse test jack J3106 to afc output test jack J3107.

Step 21. Reduce signal generator output to zero.

Step 22. Count the number of sweeps which appear on the oscilloscope in 15 seconds. Sweep should repeat between 20 and 80 times in 15 seconds.

Step 23. Turn afc sweep adjusting potentiometer R3173 fully counterclockwise and measure the peak-to-peak amplitude of the sweep viewed on oscilloscope. Peak-to-peak amplitude of sweep must be 25 volts minimum, 40 volts maximum. Take probe attenuation into consideration.

Step 24. Turn R3173 fully clockwise and repeat measurement as in step 23. Peak-to-peak amplitude of sweep must be 25 volts minimum, 40 volts maximum. Take probe attenuation into consideration.

Step 25. Remove oscilloscope from J3107 and connect VTVM between J3107 and chassis ground.

Step 26. Turn R3173 fully counterclockwise and remove sweep generator tube V3114.

Step 27. Measure the negative d-c voltage at J3107. Voltage must be minus 100 volts maximum.

Step 28. Turn R3173 fully clockwise and repeat measurement as in step 27. Voltage must be minus 140 volts minimum.

Step 29. Turn R3173 to center of its range. Disconnect test equipment. Turn system "OFF." Replace V3114.

h. SUMMARY OF MINIMUM PERFORMANCE STANDARDS, RECEIVER-AFC SECTION OF RDF-1C TRANSMITTER-RECEIVER.

TEST	SPECIFIED LIMITS OR REQUIREMENTS
STC (sensitivity time control)	
Pulse amplitude at J3101 (R3149 fully clockwise)	-20 volts minimum

TEST	SPECIFIED LIMITS OR REQUIREMENTS
STC (sensitivity time control)	
Pulse width at J3101 (R3149 full clockwise)	55 microseconds minimum 95 microseconds maximum
Pulse amplitude adjusted by R3149 to:	-7 volts at J3101
CASCODE I-F AMPLIFIER	
Minus 3-db bandpass	2.0 megacycles
Center frequency	30 megacycles
I-F AMPLIFIER (OVER-ALL)	
Minus 3-db bandpass	0.75 megacycles minimum 1.5 megacycles maximum
Center frequency	30 ±0.3 megacycle
Gain (noise output at J3102) ("GAIN" controls full clockwise)	-1.0 volt minimum
CONTOUR CIRCUIT	
Dynamic range adjusted by R3132 to:	15 db nominal
AFC CIRCUIT	
DISCRIMINATOR ALIGNMENT	
Crossover frequency	30.2 megacycles
Input for 10-volt peak pulse at J3106 (at 29.0 megacycles)	70,000 microvolts maximum
PHANTASTRON OPERATION	
Number of sweeps in 15 seconds	20 sweeps minimum 80 sweeps maximum
Sweep amplitude at J3107 (R3173 full clockwise)	25 volts peak-to-peak minimum 40 volts peak-to-peak maximum
Sweep amplitude at J3107 (R3173 full counterclockwise)	25 volts peak-to-peak minimum 40 volts peak-to-peak maximum
Voltage at J3107 (R3173 clockwise, V3114 removed)	-140 volts minimum

TEST	SPECIFIED LIMITS OR REQUIREMENTS
AFC CIRCUIT	
PHANTASTRON OPERATION	
Voltage at J3107 (R3173 counterclockwise, V3114 removed)	-100 volts maximum
Frequency required to stop phantastron sweep with 100,000-microvolt input	30.1 megacycles maximum 29.6 megacycles minimum

6-7. FINAL TESTS AND ADJUSTMENTS, COMPOSITE RDR-1C TRANSMITTER-RECEIVER.

The testing, aligning, and adjusting procedures in paragraphs 6-5 and 6-6 establish the minimum operating standards for the several sections comprising the RDR-1C Transmitter-Receiver. Since all sections of the composite unit must work together, it is necessary to make several over-all tests and adjustments after all sections are in place and properly interconnected.

The following procedures cover the final adjustments of: local-oscillator frequency, local-oscillator-output attenuator, afc lock-in range, discriminator crossover, contour circuit dynamic range, and STC range. A test of over-all receiver sensitivity and mixer crystal tests are included.

a. TEST EQUIPMENT REQUIRED.

Oscilloscope, Tektronix, type 531 with high-impedance probe
Test Set, Hewlett-Packard, type 618B
Echo Box, C-band, Narda, Model 833

Transmitter termination consisting of:

RT unit adaptor, Bendix C244177-1	)	(
Waveguide H-plane 90-degree bend, type ARA-136, Airtron 67367	)	(
Impedance matching coupler, transition, double-ridge to standard C-band waveguide, Airtron 64027	) or	(Dummy load, Airtron (high-power C-band double-ridge waveguide termination
Dummy load, C-band waveguide termination, Airtron 52152	)	(

b. PREPARATION.

Step 1. Terminate transmitter as in paragraph 6-5d(1).

Step 2. Establish the initial control settings as listed in paragraph 6-5c.

Step 3. Position receiver-afc chassis as shown in figure 1-2, using latch pin (figure 6-10) to secure chassis in this position. All electrical connections between receiver-afc chassis and transmitter main chassis must be completed, except as subsequently indicated.

Step 4. Place system in "STANDBY" and wait at least three minutes, then turn system "ON."

c. LOCAL OSCILLATOR.

(1) FREQUENCY ADJUSTMENT.

Step 1. Place meter circuit selector switch S3001 (figure 6-4) in "A SIG" position.

Step 2. Using an insulated screwdriver-type tuning tool, adjust the local-oscillator frequency until local oscillator is locked in with transmitted pulse, as indicated by a maximum steady value of crystal current on panel meter. There are normally two points at which lock-in condition can be obtained. The correct adjustment is the most clockwise lock-in point. (See figure 6-7 or 6-12 for location of local-oscillator frequency adjustment.)

CAUTION

Local-oscillator shell and frequency-adjusting screw are 300 volts above chassis potential. Observe all safety precautions while making adjustments.

(2) OUTPUT ATTENUATOR ADJUSTMENT.

Step 3. Place meter circuit selector switch S3001 in "AFC" position.

Step 4. Adjust local-oscillator output attenuator (figure 6-7 or 6-12) for a half-scale reading on panel meter.

Step 5. Place meter circuit selector switch S3001 in "A SIG" position. Panel meter reading must be between 0.4 and 0.6 of full scale. (See note following step 6.)

Step 6. Place meter circuit selector switch S3001 in "B SIG" position. Panel meter reading must be between 0.4 and 0.6 of full scale. (See note below.)

NOTE

Signal crystals CR3004 and CR3005 must each have an output between 0.4 and 0.6 milliampere and the outputs must be within 0.2 milliampere of each other. The closer the outputs agree, the greater will be the receiver sensitivity. If meter readings indicate signal crystal currents to be within 0.2 milliampere of each other, and one signal crystal current reading falls just outside the limits of 0.4 and 0.6 of full scale, a readjustment of the local-oscillator output attenuator may be made to bring both signal crystal currents within the specified limits. A recheck of the afc crystal (CR3006)

current should be made after any readjustment of the local-oscillator output attenuator to determine that the afc crystal current has not fallen below 0.35 milliampere due to the readjustment.

d. AFC LOCK-IN (SWEEP CENTERING).

Step 1. Adjust afc sweep-adjusting potentiometer R3173 (figure 6-10) clockwise until the afc unlocks as indicated by the disappearance of steady crystal currents on panel meter M3001 (meter circuit selector switch S3001 in "AFC", "A SIG", or "B SIG" position). Note position of R3173 adjustment.

Step 2. Adjust R3173 counterclockwise, through lock in, until afc unlock again occurs. Note position of R3173 adjustment.

Step 3. Set R3173 half way between the positions noted in steps 1 and 2.

Step 4. Remove i-f amplifier tube V3110. Afc should unlock.

Step 5. Replace V3110. Afc should lock.

e. AFC DISCRIMINATOR ADJUSTMENT.

Step 1. Connect echo box to directional-coupler output jack J3001 on front of transmitter.

Step 2. Connect oscilloscope "Y" axis input to video output jack J3104 or J3105 on receiver-afc chassis.

Step 3. Synchronize oscilloscope with trigger at trigger-test jack J4081 on front panel of SYN-1B Synchronizer-Amplifier-Power Supply.

Step 4. Tune echo box to transmitter frequency by peaking echo box meter.

Step 5. Adjust afc cross-over adjustment L3126 (figure 2-10) for maximum target duration (or "ring time") on oscilloscope.

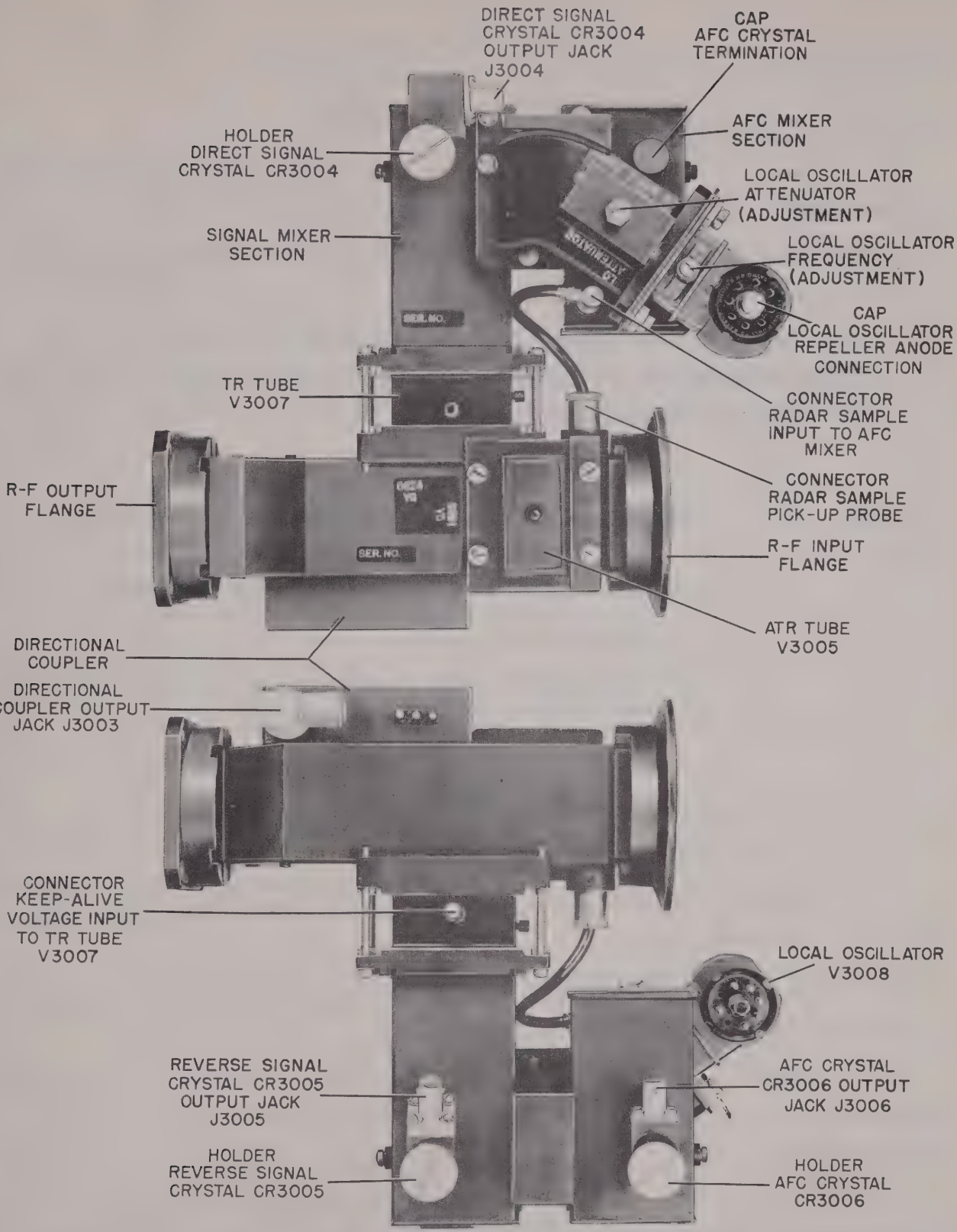

DIRECT SIGNAL CRYSTAL CR3004 OUTPUT JACK J3004
CAP AFC CRYSTAL TERMINATION
HOLDER DIRECT SIGNAL CRYSTAL CR3004
AFC MIXER SECTION
LOCAL OSCILLATOR ATTENUATOR (ADJUSTMENT)
SIGNAL MIXER SECTION
LOCAL OSCILLATOR FREQUENCY (ADJUSTMENT)
CAP LOCAL OSCILLATOR REPELLER ANODE CONNECTION
TR TUBE V3007
CONNECTOR RADAR SAMPLE INPUT TO AFC MIXER
R-F OUTPUT FLANGE
CONNECTOR RADAR SAMPLE PICK-UP PROBE
R-F INPUT FLANGE
ATR TUBE V3005
DIRECTIONAL COUPLER
DIRECTIONAL COUPLER OUTPUT JACK J3003
CONNECTOR KEEP-ALIVE VOLTAGE INPUT TO TR TUBE V3007
LOCAL OSCILLATOR V3008
REVERSE SIGNAL CRYSTAL CR3005 OUTPUT JACK J3005
AFC CRYSTAL CR3006 OUTPUT JACK J3006
HOLDER REVERSE SIGNAL CRYSTAL CR3005
HOLDER AFC CRYSTAL CR3006

Figure 6-12. Top and Bottom Views of Duplexer-Mixer Waveguide Assembly, Part of RDR-1C Transmitter-Receiver

f. OVER-ALL RECEIVER SENSITIVITY TEST.

Step 1. Disconnect echo box from directional-coupler output jack J3001 on transmitter.

Step 2. Connect test set (618B or equivalent) to directional-coupler output jack J3001 using calibrated cable of test set.

Step 3. Connect trigger from trigger test set jack J4081, on SYN-1B Synchronizer-Amplifier-Power Supply, to sync input on test set, and to the positive (+) external trigger input on oscilloscope.

Step 4. Calibrate test set as follows:

Set "FUNCTION" switch to "OFF"; zero meter by adjusting "ZERO SET" control.

Set "FREQ" control to approximately 5400 megacycles. Tune test set for maximum target on oscilloscope using "FREQ" control.

Set "FUNCTION" switch to "CW"; set meter needle to zero db by adjusting "POWER SET" control.

Set "FUNCTION" switch to "INT."

Adjust test set for 2.0-microsecond pulses.

Set "PULSE DELAY" to 300 microseconds.

Step 5. Adjust "GAIN" control, on CON-1A Control, for a noise level equal to one-third limit level.

Step 6. Adjust test set "OUTPUT ATTENUATOR" so that the video pulse observed on oscilloscope is just limiting.

Step 7. Adjust oscilloscope for one-volt-per-centimeter deflection and measure the pulse amplitude at limiting. Pulse amplitude at limiting must be 2.0 volts minimum.

Step 8. Adjust test set "OUTPUT ATTENUATOR" so that the video pulse observed on oscilloscope is just discernible. Make sure video pulse can just be observed in the grass on oscilloscope display.

Step 9. Recalibrate test set meter and frequency, maintaining the minimum discernible signal on oscilloscope by further adjusting test set "OUTPUT ATTENUATOR."

Step 10. Compute over-all receiver sensitivity by adding the attenuation of the directional coupler (as stamped on transmitter frame), test set cable, and test set "OUTPUT ATTENUATOR" reading. Sum of the above must be 100 db minimum.

g. CONTOUR LEVEL ADJUSTMENT.--The contour level adjusting procedure was given in paragraph 6-6f. If it is desired to recheck this adjustment, using the test equipment setup as in paragraph 6-7f above, proceed as follows:

Step 1. Follow steps 1 through 9 of paragraph 6-7f above. Note test set "OUTPUT ATTENUATOR" reading for minimum discernible signal.

Step 2. Place "CONTOUR-OFF" switch, on CON-1A Control, in "CONTOUR" position.

Step 3. Increase test set output level 15 db (approximately 5.62 times output level noted in step 1). Pulse center should break up and fill the pulse with noise in the opposite direction from limit level. If these results are not obtained, proceed with step 4.

Step 4. Adjust "CONTROL LEVEL" potentiometer R3132 (figure 6-10) to obtain results required in step 3.

Step 5. Place "CONTOUR OFF" switch, on CON-1A Control in "OFF" position.

h. STC RANGE ADJUSTMENT, FINAL.

Step 1. Use same test equipment setup as above.

Step 2. Adjust test set "PULSE DELAY" to maximum.

Step 3. Check that STC range adjusting potentiometer R3149 is turned fully counterclockwise.

Step 4. With test set tuned and calibrated, adjust "OUTPUT ATTENUATOR" for video signal just limiting as observed on oscilloscope at video output jack J3104 or J3105.

Step 5. Adjust "GAIN" control, on CON-1A Control, for noise level equal to one-third limit level.

Step 6. Carefully readjust test set "OUTPUT ATTENUATOR" for video signal that is just limiting. Record "OUTPUT ATTENUATOR" setting.

Step 7. Increase test set output level 18.5 db above setting recorded in step 6. This is approximately 8.4 times the input voltage level at limiting.

Step 8. Adjust pulse delay of test set so that center of video pulse appears three miles (approximately 37.5 microseconds) from the leading edge of the transmitter pulse.

Step 9. Adjust STC range adjusting potentiometer R3149 clockwise until test set video pulse is barely limiting as observed on oscilloscope.

Step 10. Lock R3149 in this position.

i. COARSE GAIN CONTROL ADJUSTMENT.--Continue with test equipment setup as above.

Step 1. Reduce test set output to zero.

Step 2. Turn "GAIN" control, on CON-1A Control, fully clockwise.

Step 3. Adjust "COARSE GAIN" control R3181 (figure 6-10) until noise, as viewed on oscilloscope, is just limiting. Lock control in this position.

Step 4. Turn system "OFF." Disconnect all test equipment. Secure receiver-afc chassis in main chassis, with all connections completed.

i. SUMMARY OF FINAL TESTS AND ADJUSTMENTS.

TEST	SPECIFIED LIMITS OR REQUIREMENTS
LOCAL OSCILLATOR	
Frequency	Manually tuned to lock in with transmitter frequency
Output attenuator	Adjusted for signal crystal currents between 0.4 and 0.6 milliampere and afc crystal current of 0.35 milliampere minimum
AFC	
Lock-in	R3173 adjusted to center of afc lock-in range
Discriminator	L3126 adjusted for maximum echo signal presentation (ring time)
OVER-ALL SENSITIVITY	Receiving system tested for over-all sensitivity of -100 dbm
CONTOUR LEVEL	R3132 adjusted to provide a 15-db dynamic range
STC RANGE	R3149 adjusted to provide, at 3 miles, a reduction in gain of 18.5 db below maximum
COARSE GAIN CONTROL	R3181 adjusted for noise at limit level, "GAIN" control on CON-1A Control full clockwise

6-8. SERVICING AIDS.

The following charts, included under this paragraph, are intended to assist in rapidly determining the cause for defective operation of the RDR-1C Transmitter-Receiver.

CHART	TABLE NO.
TROUBLE SHOOTING	6-2
TUBE SOCKET VOLTAGES, RECEIVER-AFC CHASSIS	6-3
TUBE SOCKET RESISTANCE MEASUREMENTS, RECEIVER-AFC CHASSIS	6-4
INDEX, COMPONENT SCHEMATICS AND TEST DATA	6-5
REFERENCE WAVESHAPES	Figure 6-14

The trouble-shooting chart includes a list of trouble symptoms, their probable causes, and suggested test and correction data.

Table 6-5 is an index to schematic diagrams and test data covering major replaceable electrical parts appearing in figure 6-13.

The replacement of any part should be made with a similar part having exactly the same electrical and mechanical characteristics specified for the original part. Lead dress is critical and should not be changed to facilitate a repair nor should it be otherwise disturbed.

TABLE 6-2. TROUBLE-SHOOTING CHART, RDR-1C TRANSMITTER-RECEIVER

Since the testing of common circuit components, such as vacuum tubes, resistors, capacitors, etc., is normal to trouble-shooting practices, these components, in general, are not considered in this chart. Proper input voltages to the unit under test is assumed.

WARNING

Voltages dangerous to life are present in this equipment. Maintenance personnel should observe all safety precautions while servicing this equipment.

SYMPTOM	PROBABLE CAUSE	TEST AND CORRECTION DATA
Unit fan B3001 does not operate in "STANDBY."	a. Relay K3002	a. Test K3002 operation and contacts.
	b. Capacitor C3007	b. Test phasing capacitor C3007 for open or short.
	c. Motor B3001	c. Test fan motor V3001 for frozen bearings, blade, binding, open winding.

TABLE 6-2. TROUBLE-SHOOTING CHART, RDR-1C TRANSMITTER-RECEIVER (Continued)

SYMPTOM	PROBABLE CAUSE	TEST AND CORRECTION DATA
Magnetron blower B3002 does not operate in "ON"		
1. No magnetron current indicated.	a. Relay K3001	a. Test K3001 for open circuit.
	b. Relay K3004	b. Test K3004 contacts.
	c. Relay K3005	c. Test K3005 operation and contacts.
2. With magnetron current indicated.	a. Relay K3005	a. Same as c above.
	b. Capacitor C3008	b. Test phasing capacitor C3008 for open or short.
	c. Blower motor B3002	c. Test blower motor B3002 for frozen bearings, impeller binding, open winding.
Transmitter power output low; magnetron current low.	a. High voltage	a. Check transmitter high voltage at C3001; if low, check power supply components.
	b. Modulating pulse	b. Check modulating pulse at V3004 cathode. [Refer to paragraph 6-5d(6).] If faulty, disconnect primary of pulse transformer T3005 from pulse-forming network Z3002 and connect a 50-ohm, 75-watt, non-inductive resistor from output of Z3002 to chassis ground. Test pulse output of Z3002 across resistor. If pulse is o/k, T3005 is suspect. If pulse is not o/k (poor shape, wrong pulse width, wrong pulse rate frequency), check modulator components L3002, V3002, CR3001, Z3002, and V3002 trigger.
	c. Magnetron V3004	c. Replace magnetron package.
Transmitter pulse width out of specifications.	a. Modulator components	a. Same as in b immediately above.

TABLE 6-2. TROUBLE-SHOOTING CHART, RDR-1C TRANSMITTER-RECEIVER (Continued)

SYMPTOM	PROBABLE CAUSE	TEST AND CORRECTION DATA
Transmitter-off frequency.	a. Magnetron V3004	a. Replace magnetron package.
High-voltage fuse F3001 blows.	a. Capacitor C3001	a. Test C3001 for short.
	b. Relays K3004, K3003	b. Test operation and contacts of relays K3004-K3003.
	c. Crystal CR3001	c. Test back resistance of crystal CR3001.
	d. Rectifier V3001	d. Replace V3001.
	e. Charging choke L3001	e. Test L3001 for short.
Relays K3003-K3004 continue to cycle.	a. Switch tube V3002	a. Replace V3002.
	b. Crystal CR3001	b. Test back resistance of CR3001.
	c. Magnetron V3004	c. Check magnetron filament voltage, check magnetron V3004 filament continuity, replace magnetron package.
	d. Pulse transformer T3005	d. Test for defect in T3005.
No crystals currents from signal crystals CR3004-CR3005.	a. Signal crystals CR3004-CR3005	a. Test CR3004-CR3005.
	b. TR tube V3007	b. Test TR tube V3007 and keep-alive voltage.
	c. Local oscillator V3008	c. Test V3008 and operating voltages thereto.
	d. Sweep adjustments	d. Check adjustment of afc sweep control R3173.
	e. Local oscillator output and attenuator	e. Check adjustment of local oscillator output attenuator on duplexer-mixer.
	f. Crystal current circuits, receiver chassis	f. Check crystal current circuits through receiver chassis to meter on Transmitter panel.

TABLE 6-2. TROUBLE-SHOOTING CHART, RDR-1C TRANSMITTER-RECEIVER(Continued)

SYMPTOM	PROBABLE CAUSE	TEST AND CORRECTION DATA
No crystal current from afc crystal CR3006.	a. Afc crystal CR3006	a. Test CR3006.
	b. TR tube V3007	b. Test TR tube V3007 and keep-alive voltage.
	c. Local oscillator V3008	c. Test V3008 and operating voltages thereto.
	d. Afc sweep adjustment	d. Check adjustment of afc sweep control R3173.
	e. Local oscillator output attenuator	e. Check adjustment of local oscillator output attenuator on duplexer-mixer.
	f. Crystal current circuit, afc circuit	f. Check afc crystal current circuit through afc chassis and afc circuit for other defects.
Signal crystals CR3004-CR3005 burn out.	a. Keep-alive voltage	a. Test keep-alive voltage at junction of CR3003 and R3001.
	b. Resistor R3004	b. Test series current limiting resistor R3004.
	c. TR tube V3007	c. Test TR tube V3007.
	d. Crystal termination	d. Check crystal current circuits through receiver chassis.
Afc crystal CR3006 burns out.	a. TR tube V3007	a. Test TR tube V3007 and keep-alive voltage.
	b. Crystal termination	b. Check crystal current circuits through afc chassis.
Receiver sensitivity low	a. Alignment	a. Realign receiver.
	b. Unbalanced signal crystals	b. Check signal crystals CR3004-CR3005 for balance.
	c. Detector crystal CR3101	c. Test CR3101.

TABLE 6-2. TROUBLE-SHOOTING CHART, RDR-1C TRANSMITTER-RECEIVER (Continued)

SYMPTOM	PROBABLE CAUSE	TEST AND CORRECTION DATA
No contour action	a. Relay K3101	a. Test operation and contacts of K3101.
	b. Adjustment	b. Check adjustment of contour control R3132.
No STC action or wrong range of control.	a. STC trigger	a. Check for proper STC trigger at pin 2 of V3109B.
	b. Depth adjustment	b. Check adjustment of STC depth control R3149 on receiver chassis.

TABLE 6-3. TUBE SOCKET VOLTAGES, RECEIVER-AFC CHASSIS

Conditions: All readings taken with 20,000-ohms-per-volt meter.
All cables disconnected from receiver-afc chassis except cable mating with jack J3103.
Voltages measured from tube-socket pins to chassis, except as noted "◄►" (between pins).
Contour relay K3101 unenergized.
Readings are nominal.
① For both extreme positions of R3132.
② For both extreme positions of R3149.
③ For both extreme positions of R3173.
* These readings taken with V3114 removed from socket.

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V3101	6.3 ac	1.25	0	142	-	115	0	1.0	0
V3102	0	.85	6.3 ac	0	130	130	.85	-	-
V3103	-1.4	.55	6.3 ac	0	130	130	.55	-	-
V3104	-1.6	.65	6.3 ac	0	130	130	.65	-	-
V3105	0	2.6	6.3 ac	0	130	130	2.6	-	-
V3106	125	0	0	6.3 ac	6.3 ac	135	0	1.6	0
V3107	300	-26 ① -44	2	6.3 ac	6.3 ac	135	0	2	0
V3108	140	-.8	1.3	6.3 ac	6.3 ac	1.5	-.8	0	140
V3109	0	-20 ② -80	0 ② -75	6.3 ac	6.3 ac	-35 ① -59	-35 ① -59	-26 ① -44	0
V3110	0	2.2	6.3 ac	0	135	135	2.2	-	-
V3111	210	0	3.3	6.3 ac	6.3 ac	210	0	3.3	-
V3112	180	0	1.35	6.3 ac	6.3 ac	180	0	1.4	0
V3113	-250	-250	6.3 ac ◄► 6.3 ac -250 -250		-250	-	-250	-	-
V3114	-180*	-250	6.3 ac ◄► 6.3 ac -250 -250		-8 ③ -19	-60*	-180*	-	-

TABLE 6-4. TUBE SOCKET RESISTANCES, RECEIVER-AFC CHASSIS

Conditions: All measurements from tube socket pins to chassis. Receiver-afc chassis completely disconnected from transmitter chassis. All tubes in place. Contour relay K3101 unenergized. ① For both extreme positions of R3132. ② For both extreme positions of K3173. Readings are nominal. K = 1000. M = 1,000,000.

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V3101	0.4	220	0	567K	-	568K	0.3	220	0
V3102	57K	82	0.3	0	566K	566K	82	-	-
V3103	165K	1K	0.3	0	566K	566K	1K	-	-
V3104	164K	1K	0.3	0	566K	566K	1K	-	-
V3105	0.1	1K	0.3	0	566K	566K	1K	-	-
V3106	581K	470K	220	0.4	0.4	575K	470K	2.7K	0
V3107	∞	71K ① 102K	5.6K	0.4	0.4	580	56K	5.6K	0
V3108	566K	534K	2.2K	0.4	0.4	2.2K	534K	0	566K
V3109	56K	35K ② 40K	0 ② 37K	0.4	0.4	71K ① 102K	71K ① 102K	540K ① 570K	0
V3110	0.2	180	0.3	0	566K	566K	180	-	-
V3111	∞	2.35K	10K	0.3	0.3	∞	2.35K	10K	0
V3112	∞	22K	100	0.3	0.3	∞	22K	100	0
V3113	114K	2.3M	∞	∞	114K	-	2.3M	-	-
V3114	4.51M	114K	∞	∞	830K	72K	2.26M	-	-

TABLE 6-5. INDEX, COMPONENT SCHEMATICS AND TEST DATA

COMPONENT SYMBOL	DESCRIPTION	REFER TO FIGURE 6-13, DIAGRAM
K3001	THERMAL TIME-DELAY RELAY	M
K3002	STANDBY RELAY	K
K3003	HIGH VOLTAGE RELAY	H
K3004	OVERLOAD PROTECT RELAY	N
K3005	MAGNETRON FILAMENT CONTROL RELAY	K
K3101	CONTOUR RELAY	K
L3001	CHARGING CHOKE	G
S3001	METER CIRCUIT SELECTOR SWITCH	L
T3001	HIGH VOLTAGE TRANSFORMER	A
T3002	FILAMENT TRANSFORMER (RECEIVER-AFC-LOCAL OSCILLATOR)	B
T3003	FILAMENT TRANSFORMER (MAGNETRON-THYRATRONS)	C
T3004	RECTIFIER FILAMENT AND KEEP-ALIVE HIGH VOLTAGE TRANSFORMER	I
T3005	MAGNETRON PULSE TRANSFORMER	J
T3006	SWITCH DRIVER PULSE TRANSFORMER	F
Z3001	SWITCH DRIVER PULSF-FORMING NETWORK	D
Z3002	RADAR PULSE-FORMING NETWORK	E

6-9. CHECK LIST, SYSTEM OPERATION.

Table 6-6 provides a simple check-off list of operational tests to be performed, after repair or overhaul, and a preferred sequence for performing them. The tests require a complete system hook-up.

Establish the initial control settings as given in paragraph 6-5c, remove high voltage fuse F3001, and test system operation by following the chart below.

TABLE 6-6. SYSTEM OPERATION CHECK LIST

UNIT	TEST	DESIRED RESULTS	REMARKS
RDR-1C	1 Blower motor B3001	Normal operation	"STANDBY" position
SYN-1B	2 Blower motor B4001	Normal operation	"STANDBY" and "ON"
	3 -250-volt bias voltage	Meter M4001 reads mid-scale	"STANDBY" and "ON" (Allow for filament warm-up)
RDR-1C	4 Magnetron blower B3002	Normal operation	While system is "ON" only
SYN-1B	5 +260-volt power supply	Meter M4001 reads mid-scale	System "ON"
	6 +300-volt power supply	Meter M4001 reads mid-scale	
	7 +140-volt power supply	Meter M4001 reads mid-scale	
RDR-1C	8 Crystal currents (A-SIG, B-SIG, AFC)	Meter M3001 swinging at approximately two cycles per second	
	9 Keep-alive voltage	-600 volts minimum measured at TR tube cap	

TABLE 6-6. SYSTEM OPERATION CHECK LIST (Continued)

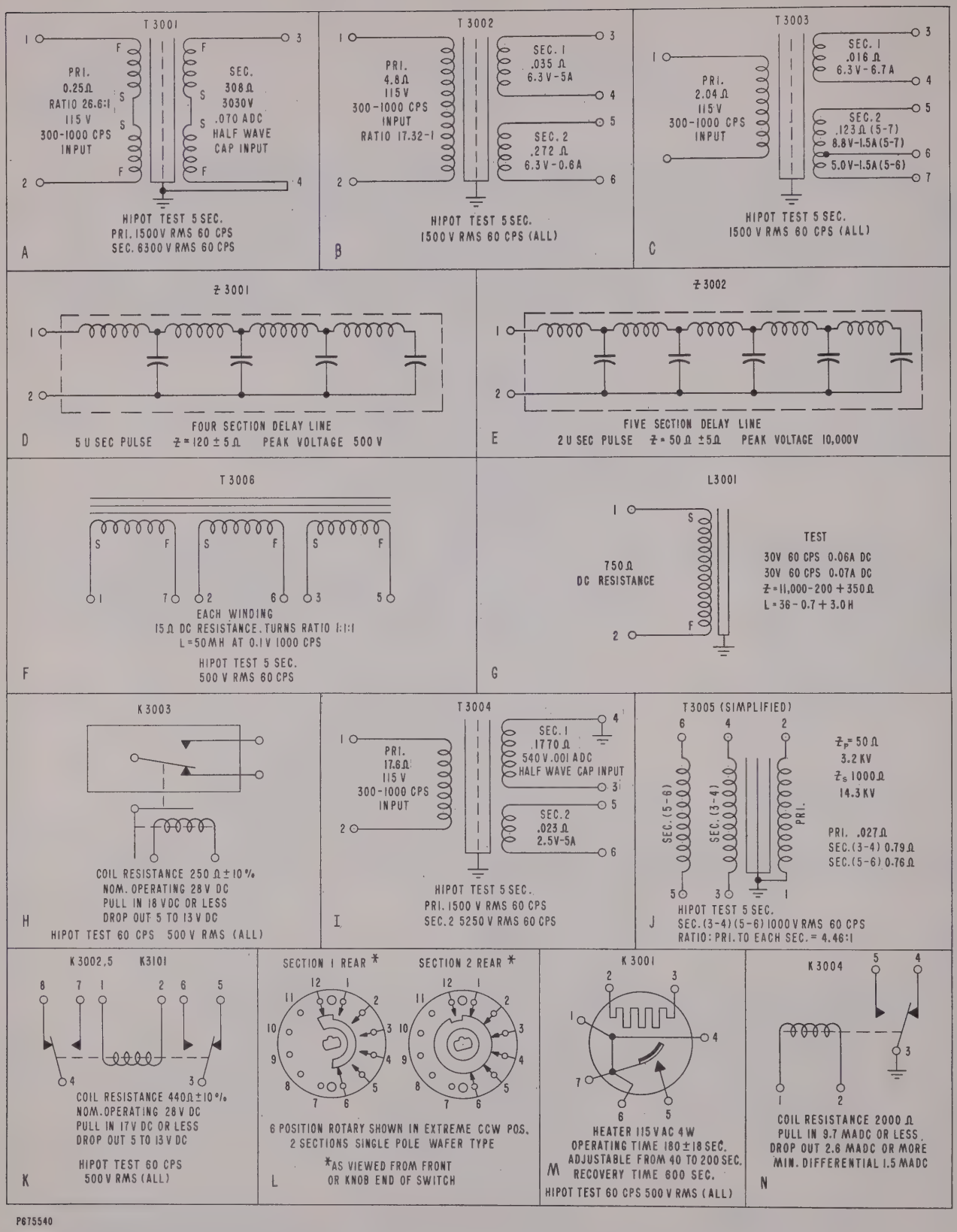
UNIT	TEST	DESIRED RESULTS	REMARKS
PPI-1B,D	Sweep Trace		
	10 Brilliance	Full, heavy trace	"GAIN" control on CON-1A full CCW. "BRILLIANCE" control on PPI-1( ) full CW.
	11 Focus	Clean, fine range marks	
	12 Decentering	Each sweep starts at apex of PPI-1( ) face overlay	Adjust as necessary.
	13 Rotation and speed	Clockwise rotation synchronized with antenna (15 +3 rpm)	Sweep trace not to be curved or intermittant.
	Range and Marks		
	14 20-mile range	4 equally-spaced range marks	Last range mark for each range to appear within one-eighth in. of top edge of scope display when sweep is at zero degrees in azimuth.
	15 50-mile range	5 equally-spaced range marks	
	16 150-mile range	6 equally-spaced range marks	
	17 Graticule illumination	Full control of graticule illumination from "off to bright"	"DIMMER" control on PPI-1( ) full CCW to full CW.
	18 Indicator-antenna zero alignment	Scope trace at zero-degree azimuth	Antenna stopped and positioned at zero-degree azimuth (dead-ahead)
RDR-1C	19 I-F Course gain setting	"COURSE GAIN" control on receiver so adjusted that scope display just saturates with noise	"GAIN" control, on CON-1A, full CW.

TABLE 6-6. SYSTEM OPERATION CHECK LIST (Continued)

UNIT	TEST	DESIRED RESULTS	REMARKS
RDR-1C (Cont.)	20 Contour operation check	Dark band appearing within video swath	115 volts, 400 cps applied at pin 8 of jack J3103 on receiver chassis (not on early models)
ANT-1( )	21 Tilt zero-degree setting	Antenna tilt indicated at zero-degree when "ANT-TILT" control, on CON-1A, is set at zero	Antenna rotation stopped, no gyro input
SERVO SYSTEM	22 PPI No. 1 servo loop operation	PPI indicator trace follows antenna rotation smoothly	Antenna rotating. Input to servo amplifier number one, in SYN-1B, does not exceed 1.3 volts P-P at any time.
	23 PPI No. 2 servo loop operation	Same as test 22	(If used)
	24 Tilt servo sensitivity	Tilt servo amplifier gain adjusted so that "ANT-TILT" control on CON-1A need not be changed by more than 0.5 degree to initiate corrective action.	Antenna rotation stopped
	25 Tilt control accuracy	Plus or minus ten degrees of antenna tilt indicated for ±10-degree settings of "ANT-TILT" control on CON-1A	Antenna rotation stopped, no gyro input

TABLE 6-6. SYSTEM OPERATION CHECK LIST (Continued)

UNIT	TEST	DESIRED RESULTS	REMARKS
SERVO SYSTEM (Cont.)	26 Pitch stabilization	"PITCH GAIN" and "PITCH PHASE" controls in SYN-1B, adjusted so that 10 degrees of gyro input to pitch function is cancelled out by 10-degree setting of "ANT-TILT" control on CON-1A. (Measured at test jack J4051 on SYN-1B)	Antenna rotation stopped and set at zero-degree azimuth (dead ahead)
	27 Roll stabilization	"ROLL GAIN" and "ROLL PHASE" controls, in SYN-1B, adjusted so that 10 degrees of gyro input to roll function is cancelled out by 10-degree setting of "ANT-TILT" control on CON-1A. (Measured at test jack J4051 on SYN-1B)	Antenna rotation stopped and oriented 90 degrees from zero azimuth
CON-1A	28 Panel illumination	Adjustable from off to bright	"DIMMER" control from fully counterclockwise to full clockwise
	NOTE Before proceeding with further tests, re-establish the initial control settings as given in paragraph 6-5c. Reinstall high voltage fuse F3001.		
RDR-1C	29 Magnetron current	Meter M3001 steady near mid-scale (minimum 0.3 of full scale)	System "ON"
	30 Afc lock-in	Meter M3001 steady near mid-scale	For meter circuit selector switch S3001 positions: "A SIG", "B SIG", and "AFC"


T 3001
PRI. 0.25Ω RATIO 26.6:1 115 V 300-1000 CPS INPUT
SEC. 308Ω 3030V .070 ADC HALF WAVE CAP INPUT
HIPOT TEST 5 SEC. PRI. 1500V RMS 60 CPS SEC. 6300 V RMS 60 CPS
A
T 3002
PRI. 4.8Ω 115V 300-1000 CPS INPUT RATIO 17.32-1
SEC. 1 .035 Ω 6.3 V-5A
SEC. 2 .272 Ω 6.3 V-0.6A
HIPOT TEST 5 SEC. 1500 V RMS 60 CPS (ALL)
B
T 3003
PRI. 2.04Ω 115V 300-1000 CPS INPUT
SEC. 1 .016 Ω 6.3 V-6.7 A
SEC. 2 .123Ω (5-7) 8.8V-1.5A(5-7) 5.0V-1.5A(5-6)
HIPOT TEST 5 SEC. 1500 V RMS 60 CPS (ALL)
C
Z 3001
FOUR SECTION DELAY LINE
5 U SEC PULSE Z = 120 ± 5Ω PEAK VOLTAGE 500 V
D
Z 3002
FIVE SECTION DELAY LINE
2 U SEC PULSE Z = 50 Ω ±5Ω PEAK VOLTAGE 10,000V
E
T 3006
EACH WINDING 15 Ω DC RESISTANCE. TURNS RATIO 1:1:1 L=50 MH AT 0.1V 1000 CPS
HIPOT TEST 5 SEC. 500 V RMS 60 CPS
F
L3001
750Ω DC RESISTANCE
TEST 30V 60 CPS 0.06A DC 30V 60 CPS 0.07A DC Z = 11,000-200 + 350Ω L = 36 - 0.7 + 3.0 H
G
K 3003
COIL RESISTANCE 250 Ω ± 10 % NOM. OPERATING 28 V DC PULL IN 18 VDC OR LESS DROP OUT 5 TO 13 V DC HIPOT TEST 60 CPS 500 V RMS (ALL)
H
T3004
PRI. 17.6Ω 115 V 300-1000 CPS INPUT
SEC. 1 1770 Ω 540 V .001 ADC HALF WAVE CAP INPUT
SEC. 2 .023 Ω 2.5V-5A
HIPOT TEST 5 SEC. PRI. 1500 V RMS 60 CPS SEC. 2 5250 V RMS 60 CPS
I
T3005 (SIMPLIFIED)
SEC. (5-6) SEC. (3-4) PRI.
Zp = 50 Ω 3.2 KV Zs 1000 Ω 14.3 KV
PRI. .027 Ω SEC. (3-4) 0.79 Ω SEC. (5-6) 0.76 Ω
HIPOT TEST 5 SEC. SEC. (3-4) (5-6) 1000 V RMS 60 CPS RATIO: PRI. TO EACH SEC. = 4.46:1
J
K3002,5 K3101
COIL RESISTANCE 440Ω ± 10 % NOM. OPERATING 28 V DC PULL IN 17 V DC OR LESS DROP OUT 5 TO 13 V DC
HIPOT TEST 60 CPS 500 V RMS (ALL)
K
SECTION 1 REAR * SECTION 2 REAR *
6 POSITION ROTARY SHOWN IN EXTREME CCW POS. 2 SECTIONS SINGLE POLE WAFER TYPE
*AS VIEWED FROM FRONT OR KNOB END OF SWITCH
L
K 3001
HEATER 115 V AC 4 W OPERATING TIME 180 ± 18 SEC. ADJUSTABLE FROM 40 TO 200 SEC. RECOVERY TIME 600 SEC.
HIPOT TEST 60 CPS 500 V RMS (ALL)
M
K 3004
COIL RESISTANCE 2000 Ω PULL IN 9.7 MADC OR LESS DROP OUT 2.6 MADC OR MORE MIN. DIFFERENTIAL 1.5 MADC
N

P675540

Figure 6-13. Electrical Components of RDR-1C Transmitter-Receiver, Schematic Diagrams and Test Data

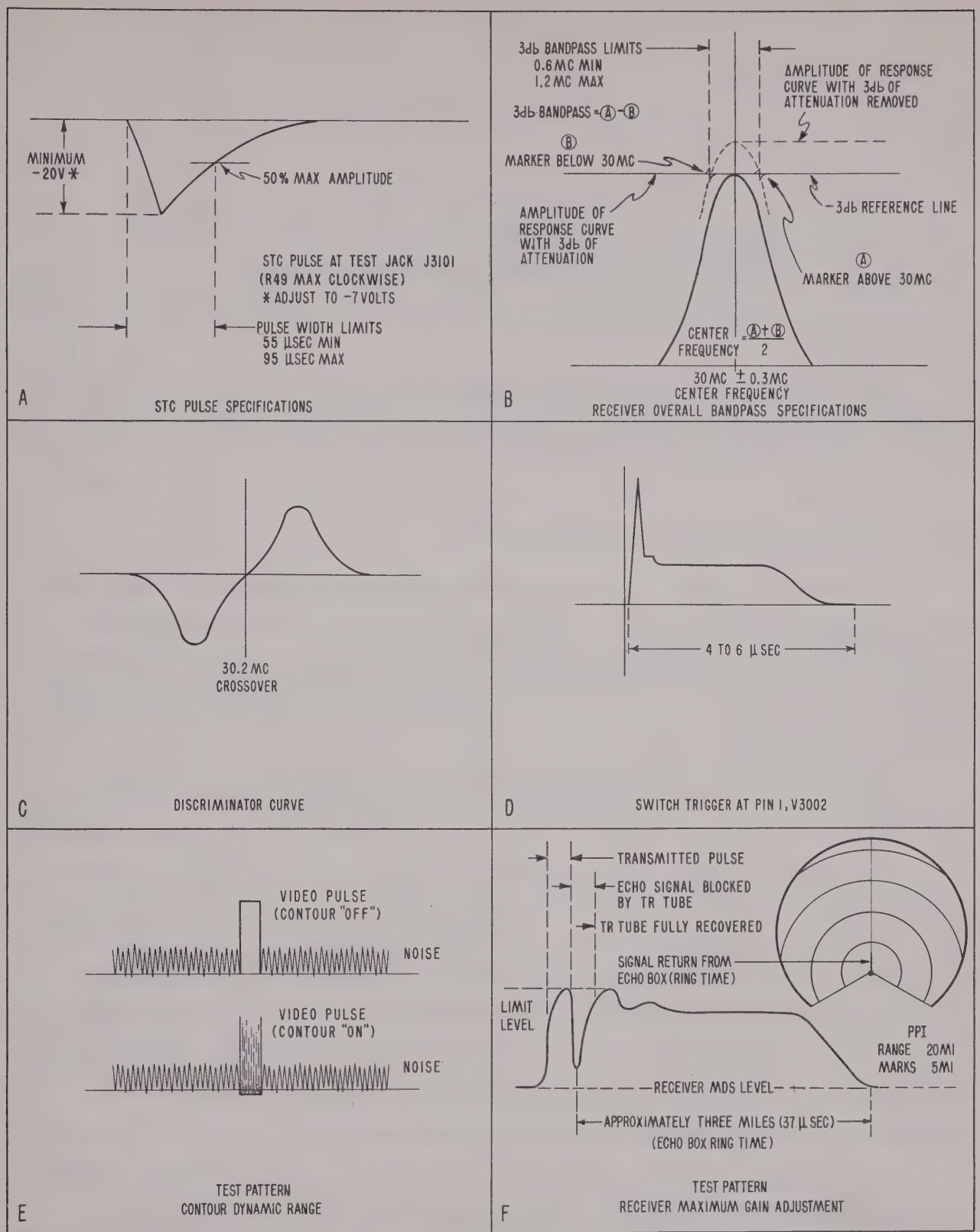


Figure 6-14. Reference Waveshapes

SECTION VII
SUPPLEMENTARY DATA AND MODIFICATION

7-1. GENERAL.

This section includes information relative to modifications and improvements to, and optional features available for the type RDR-1C Transmitter-Receiver.

7-2. CONTOUR TEST FACILITY, ADDITION.

A means for testing the operation of the contour circuit of the receiver is included in all current models. The test is actually a "GO-NO GO" check which can be made in flight as well as on the test bench. It is not intended to check the actual adjustment of the contour circuit, but is intended to assure the pilot that the contour circuit is or is not functioning.

The "CONTOUR TEST" circuit included in the receiver is shown in the receiver schematic diagram, figure 9-2. (See pin 8 of jack J3103.)

In order to use the "CONTOUR TEST" feature in flight, the aircraft installation should include a single-pole push-to-make switch, or a spst toggle switch, installed convenient to the pilot. The switch should be connected to operate a 28-volt d-c single-pole relay installed on or near the aircraft junction strip. One contact of the relay should be connected to the 115-volt 400-cycle synchronizer reference phase (the same phase feeding pin 30 of connector P4001 on the SYN-1B Synchronizer-Amplifier-Power Supply); the other contact should be connected to feed pin 22 of connector P3001 on the RDR-1C Transmitter-Receiver.

The "CONTOUR TEST" is effective only when the system is in full operation and "CONTOUR-OFF" switch, on CON-1A Control, is in "CONTOUR" position.

When the "CONTOUR TEST" switch is depressed (closed) approximately 2.5 volts of the 400-cycle supply voltage is applied to the contour circuit in the receiver at the junction of inductor L3109 and capacitor C3133. This causes a dark band to appear within the video swath on the PPI indicator when the contour circuit is functioning.

Absence of the dark band, for the conditions described above, warns the pilot of contour circuit malfunctioning, in which case actual storm center detection would not occur.

7-3. MAGNETRON BLOWER B3002, CHANGE.

Type RDR-1C Transmitter-Receiver units below serial number 1000 are equipped with a high-speed magnetron blower motor (B3002) which requires a 1.0-microfarad phasing capacitor (C3008).

Type RDR-1C Transmitter-Receiver units above serial number 1000 are equipped with a medium speed magnetron blower motor (B3002) which requires a 0.15-microfarad phasing capacitor.

The newer, medium speed motor has a longer life rating and is not directly interchangeable with the higher speed motor.

Illustration A of figure 7-2 is a partial schematic diagram showing the connections to the original high-speed motor (B3002) and the associated phasing capacitor (C3008).

Illustration B of figure 7-2 is a partial schematic diagram showing the connections to the newer, medium-speed motor (B3002) and the associated phasing capacitor (C3008).

Terminal board TB3002 has been added to the transmitter chassis, simplifying motor and capacitor removal and installation for servicing or replacement.

The parts list in section VIII of this handbook lists the proper replacement part numbers for both types of motor B3002 and the required phasing capacitor C3008.

7-4. THERMAL CUTOUT SWITCH S3002, ADDITION.

A thermal cutout switch (thermostat) S3002 is incorporated in all RDR-1C Transmitter-Receivers above serial number 1000.

This thermostat is in contact with magnetron oscillator V3004, and is held in place by a strap secured around the magnetron. (See figure 7-1.)

The normally closed contacts of the thermostat are connected in series with the 28-volt d-c "ON" control voltage as shown in figure 7-1. The thermostat is set to open the "ON" control voltage circuit when the magnetron temperature reaches 190 ±8 degrees F at the point of thermostat contact, thus limiting the system to "STANDBY" attitude. When the magnetron temperature falls to 170 ±8 degrees F, at the point of thermostat contact, the thermostat will re-establish (contacts closed) the "ON" control voltage circuit allowing full "ON" operation of the system.

The addition of thermal cutout switch S3002 provides a high degree of protection against damage to magnetron oscillator V3004 due to overheating. Overheating may be caused by failure of phasing capacitor C3008, magnetron blower motor B3002, magnetron filament voltage control relay K3005, or other causes inherent in magnetron operations.

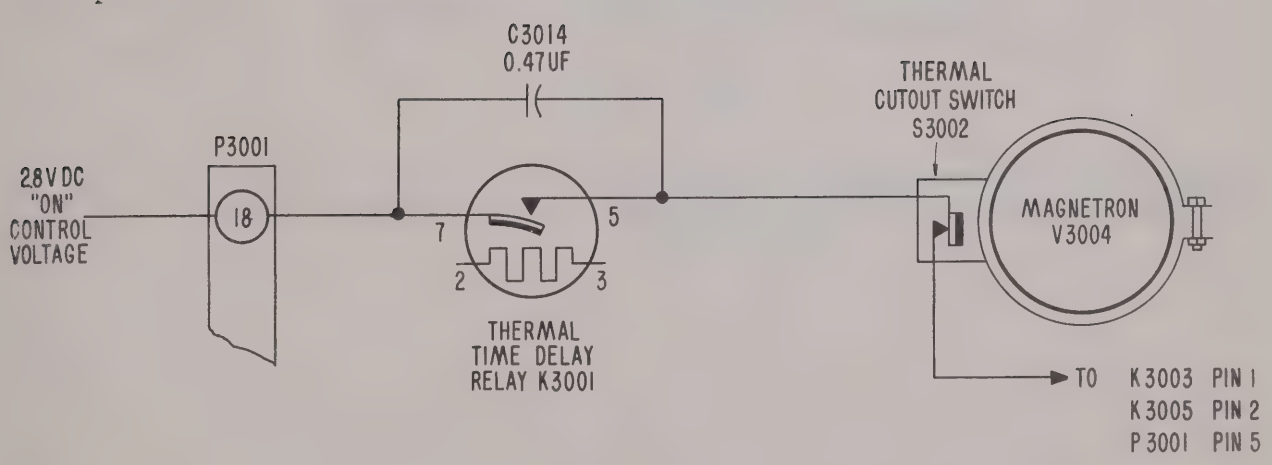
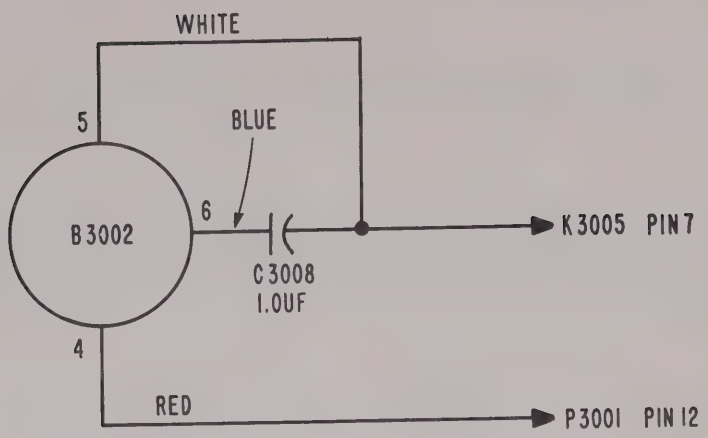


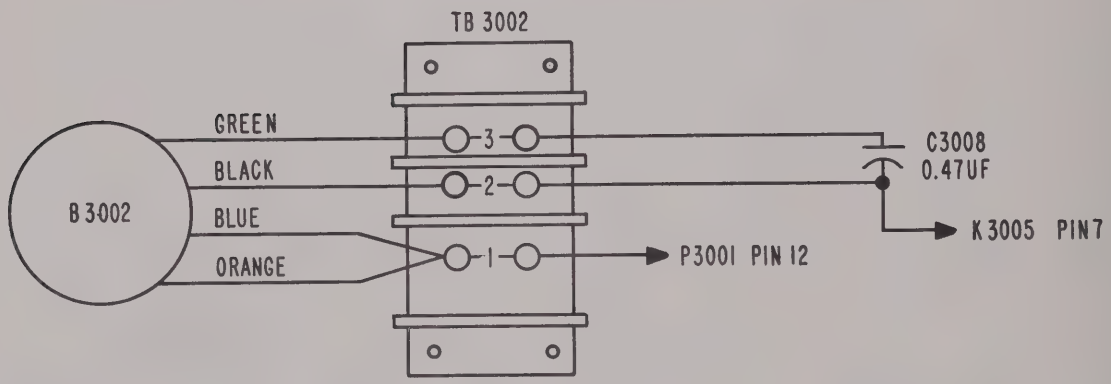
Figure 7-1. Modification to RDR-1C Transmitter-Receiver Showing Capacitor C3014 and Switch S3002 Additions, Partial Schematic Diagram

A



Magnetron Blower Motor B3002 and Phasing Capacitor C3008 Connections in RDR-1C Transmitter-Receiver Units Below Serial Number 1000

B



Magnetron Blower Motor B3002, Phasing Capacitor C3008, and Terminal Board TB3002 Connections in RDR-1C Transmitter-Receiver Units Above Serial Number 1000

Figure 7-2. Modification to RDR-1C Transmitter-Receiver Showing Wiring Differences For Blower Motor B3002 and Phasing Capacitor C3008, Partial Schematic Diagrams

SECTION VIII
PARTS LIST

8-1. GENERAL.

This section contains a separate electrical parts list for each of the following sections of the RDR-1C Transmitter-Receiver.

Section	Symbol Number Series	Schematic Diagram Figure Number
Modulator-Transmitter	3000 to 3099	9-1
Receiver-Afc	3100 to 3199	9-2

In addition to the above, an exploded view drawing of the duplexer-mixer waveguide assembly W3001 (figure 8-1) is included with a parts breakdown list coded to the drawing. Note that all parts numbers shown on the parts breakdown list are AIRTRON part numbers.

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		MOTORS	
B3001	Unit blower	Fan, ventilating, propeller 115 VAC, 400 cps	L220906-2
B3002	Magnetron blower (See "A" figure 7-2.)	Fan, propeller, 115 VAC, 400 cps (For replacement only in units below serial number 1000.)	L220906-3
B3002	Magnetron blower (See "B" figure 7-2.)	Fan, propeller, 115 VAC, 400 cps (For replacement only in units above serial number 1000.)	L2088035-1
		CAPACITORS	
C3001	High-voltage filter	0.25 uf ±10%, plastic, 5000 VDCW	C220147-4
C3002	Keep-alive filter	0.1 uf +20% -10%, paper, 1500 VDCW	CP29A1EH104V
C3003	Magnetron-filament bypass	2 x 0.25 uf +20% -10%, paper, 600 VDCW	CP54B6EF254V
C3004	Relay (K3004) overload bypass	50 uf +150%, -10%, electrolytic, 50V	CE64C500G
C3005	Trigger coupling	6800 uuf ±10%, mica, 300 VDCW	CM35B682K
C3006	Magnetron-filament bypass	Part of E3002	CM35B472K
C3007	Unit blower, phasing	1.0 uf +20% -15%, paper, 600 VDCW	CP54B1EF105V
C3008	Magnetron blower, phasing (See "A", figure 7-2.)	1.0 uf +20% -15%, paper, 600 VDCW (For replacement only in units under serial number 1000.)	CP54B1EF105V
C3008	Magnetron blower, phasing (See "B", figure 7-2.)	0.15 uf, +20% -10%, paper 250 VDCW (For replacement only in units above serial number 1000.)	L2088041-1
C3010	R-f bypass, meter	0.01 uf +100% -0%, ceramic, 350 VDCW	L220284-1
C3011	Bypass	2 x 0.1 uf ±10%, paper, 400 VDCW	CP53B6EF104V
C3012	Relay (K3004) overload bypass	0.1 uf ±10%, paper, 400 VDCW	L220152-13F

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		CAPACITORS (Continued)	
C3013	De-spiking	100 uuf ±5 uuf, 20 kv pulse working	C2088047-1
C3014	Relay stabilizing (See figure 7-1.)	0.47 uf ±10%, paper, 100 VDCW	CP10AEB474K
		CRYSTALS	
CR3001	Clipper diode	Rectifier, selenium	C291642-2
CR3002	Clipper diode	Rectifier, selenium	C291642-2
CR3003	Rectifier, keep-alive voltage supply	Rectifier, selenium	C291625-2
CR3004	Signal crystal	1N23C, silicon diode (supplied with W3001)	1N23C
CR3005	Signal crystal	1N23C, silicon diode (supplied with W3001)	1N23CR
CR3006	Afc crystal	1N23C, silicon diode (supplied with W3001)	1N23CR
		CONNECTORS	
E3001	KA voltage input to TR tube V3007	Cable assembly, 3.3-megohm built-in resistor R3004 and cap connector	C223661-1
E3002	Magnetron connector	Socket, 4700 uuf capacitor (C3006) built in	C283599-1
		FUSES	
F3001	High voltage transformer (T3001) protect	5 amp, slow-blow, type 3 AG	C221603-5602
F3002	Receiver filaments transformer (T3002) protect	1/2 amp, slow-blow, type 3 AG	C221603-5501
F3003	Magnetron, thyratron filaments transformer (T3003) protect	3/4 amp, slow-blow, type 3 AG	C221603-5751

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		FUSES (Continued)	
F3004	Keep-alive voltage supply-transformer (T3004) protect	1/4 amp, slow-blow, type 3 AG	C221603-5251
		JACKS	
J3001	Directional coupler, output test jack	Panel jack, type N (part of W3002)	C223390-15
J3003	Directional coupler, output	Jack, type N, part of W3001 (not replaceable separately)	
J3004	Signal output	Jack, BNC, part of W3001 (not replaceable separately)	
J3005	Signal output	Jack, BNC, part of W3001 (not replaceable separately)	
J3006	Afc crystal output	Jack, BNC, part of W3001 (not replaceable separately)	
		RELAYS	
K3001	Time delay	115 VAC, thermal type, adjustable (5 min. nominal)	C218675-1
K3002	Preheat	28 VDC, armature type, dpdt, d-c coil resistance 345 ohms	L218814-1
K3003	High voltage	28 VDC, armature type, spdt sb, d-c coil resistance 250 ohms	C218680-1
K3004	Overload	Spdt, d-c coil resistance 2000 ohms, sensitive 10 ma.	L218816-2
K3005	Magnetron-filament	28 VDC, armature type, dpdt, d-c coil resistance 345 ohms, 4 amp contacts	L218814-1
		COILS AND INDUCTORS	
L3001	Charging choke	Reactor assembly, 36h, 70 ma	N285021-1

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		METERS	
M3001	Crystal, magnetron current monitor	0-1 ma dc	C291548-3
M3002	Time totalizing	115 VAC, 400 cps, running time meter	L291564-2
		PLUGS	
P3001	Unit interconnect	30-contact plus 2 coaxial, type DPD-32C2-34P	C223409-6
P3003	Directional-coupler output	Type N plug (part of W3002)	C223390-49
P3004	Video output	Type BNC plug (part of W3003)	UG-260/U
P3005	Video output	Type BNC plug (part of W3004)	UG-260/U
P3006	Receiver power	25 pin, type DB-25S	OC287100-1
		RESISTORS	
R3001	Keep-alive load	270K ohms ±10%, 1/2w, comp	RC20BF274K
R3002	Keep-alive load	270K ohms ±10%, 1/2w, comp	RC20BF274K
R3003	Keep-alive load	270K ohms ±10%, 1/2w, comp	RC20BF274K
R3004	Keep-alive series	Part of E3001 (not replaceable separately)	
R3005	Trigger isolation	470 ohms ±10%, 1w, comp	RC30BF471K
R3006	Trigger match	1000 ohms ±10%, 1w, comp	RC30BF102K
R3007	Charging resistor	33K ohms ±10%, 2w, comp	RC41BF333K
R3008	Grid isolation	390 ohms ±10%, 1w, comp	RC30BF391K
R3009	Divider	270K ohms ±10%, 1w, comp	RC30BF274K
R3010	Divider	10K ohms ±10%, 1/2w, comp	RC20GF103K
R3011	Meter shunt	1.4 ohms ±1%, 1/4w, wirewound	RB15K1R400F

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		SWITCHES	
S3001	Meter-circuit selector	Wafer, Oak type F	C218385-87
S3002	Magnetron protect (See figure 7-1.)	Thermal cutout switch, closed 190 ±8° F, open 170 ±8° F	L2088054-1
		TRANSFORMERS	
T3001	High voltage plate	0.25 ohms, pri; 308 ohms, sec. Input: 115V 300-1000 cps; output: (terminals 3 and 4) 3030V at 0.07A dc	N285106-1
T3002	Receiver, afc, local oscillator filaments	4.8 ohms, pri; 0.035 ohms (terminals 3 and 4); 0.272 ohms (terminals 5 and 6) sec. Input: 115V 300-1000 cps. Output: 6.3V (terminals 3 and 4) at 5 amp; 6.3V (terminals 5 and 6) at 0.6 amp	N285009-1
T3003	Magnetron, thyratron filament	2.04 ohms, pri; 0.016 ohms (terminals 3 and 4), 0.123 ohms (terminals 5 and 7) sec. Input: 115V 300-1000 cps. Output: 6.3V (terminals 3 and 4) at 6.7 amp; 8.8V (terminals 5 and 7) at 1.5 amp; 5.0V (terminals 5 and 6) at 1.5 amp	N285018-3
T3004	Rectifier (V3001) filament supply keep-alive H.V.	17.6 ohms, pri; 1770 ohms (terminals 3 and 4), 0.023 ohms (terminals 5 and 6), sec. Input: 115V 300-1000 cps. Output: 540V (terminals 3 and 4) at .001 amp dc; 2.5V (terminals 5 and 6) at 5 amp	N285107-1
T3005	Magnetron pulse	0.027 ohms, pri; 0.79 ohms (terminals 3 and 4), 0.76 ohms (terminals 5 and 6) sec; Inductance: 2.0 mh (terminals 1 and 2) at 3V, 1000 cps; Turns ratio 4.46:1 to each secondary. Zp = 50 ohms; Zs = 1000 ohms	OR285233-1

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		TRANSFORMERS (Continued)	
T3006	Pulse for switch driver V3003	15 ohms each winding (1-7, 2-6, 3-5) L = 50 mh at 0.1V, 1000 cps. Turns Ratio 1:1:1. Rise time 0.3 usec. Pulse width 4 usec. Rep rate 400 pps	L285029-1
		TERMINAL BOARDS	
TB3002	Junction strip	10 dual terminals	L678008-1
TB3002	Junction strip	3 dual terminals	L678164-3
		VACUUM TUBES	
V3001	High-voltage rectifier	Electron tube, half-wave rectifier, diode, type 582	A291920-1
V3002	Switch	Electron tube, hydrogen thyratron, type 6268/AX9911	6268/AX9911
V3003	Switch	Electron tube, hydrogen thyratron, tetrode, type 5727	5727
V3004	Oscillator	Electron tube, magnetron, type QK456	A291922-1
V3005	ATR	Switch, contact, anti-TR, gas, type 6591, (supplied with W3001)	6591
V3007	TR	Switch, contact, TR, gas, type 6624 (supplied with W3001)	6624
V3008	LO	Klystron, type VA221H	A291923-1
V3009	Spark gap	Suppressor, Electrical surge	C678216-2
		WAVEGUIDES	
W3001	Duplexer-mixer	Waveguide assembly	N244229-1
W3002	Cable, coupling, directional coupler output	Coax cable assembly (includes J3001 and P3003)	L212736-52
W3003	Video output	Coax cable assembly (includes P3004)	L212875-19
W3004	Video output	Coax cable assembly (includes P3005)	L212875-19

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		SOCKETS	
XF3001	Holder for F3001	Holder, fuse, 3 AG	A32049
XF3002	Holder for F3002	Holder, fuse, 3 AG	A32049
XF3003	Holder for F3003	Holder, fuse, 3 AG	A32049
XF3004	Holder for F3004	Holder, fuse, 3 AG	A32049
XK3001	Socket for delay relay K3001	Tube socket, 7-pin miniature	C223470-3
XT3006	Socket for pulse transformer T3006	Tube socket, 7-pin miniature	TS102P01
XV3001	Tube socket	4-pin, ceramic	C287259-1
XV3002	Tube socket	4-pin, jumbo	C223300-2
XV3003	Tube socket	7-pin miniature, phenolic	TS102P01
XV3008	Tube socket	Tube socket, Octal socket for V3008 (base cover for XV3008, with side outlet)	A287352-1 A686724-1
		PULSE LINES	
Z3001	Pulse-forming network	Delay line, 5-usec pulse, 120 ohms	L217256-2
Z3002	Pulse-forming network	Delay line, 2-usec, 10 kv, 50 ohms	C220342-1
		MISCELLANEOUS REPLACEABLE PARTS	
		Bracket, "L", chassis holddown	A245342
		Clamp, tube (locks V3001)	A74947-3
		Clamp, tube (locks V3002)	C241010-6
		Clip, electrical connector for spark gap V3009	C293239-6
		Cover for J3001, cap and chain	MX913U
		Fastener, chassis cover, Springlock	A233481-3

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (MODULATOR-TRANSMITTER SECTION) (Cont.)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		MISCELLANEOUS REPLACEABLE PARTS (Continued)	
		Knob, control, for switch S3001	L245269-13
		Plate cap, connector, (V3001, V3002)	A114371
		Plate cap, connector (V3008 repeller anode)	C2085104-1
		Shield, tube (for T3006)	TS102U01
		Shield, tube (for V3003)	TS102U01
		Tool, aligning, insulated (for V3008)	A221732-1

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		CAPACITORS	
C3101	Input coupling	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3102	Input coupling	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3103	Crystal-current filter	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3104	Crystal-current filter	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3105	Crystal-current filter	1000 uuf ±20%, ceramic, standoff, 500 VDCW	C220136-1
C3106	Crystal-current filter	1000 uuf ±20%, ceramic, standoff, 500 VDCW	C220136-1
C3107	Crystal-current filter	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3108	Crystal-current filter	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3109	Tuning	12 uuf ±10%, mica, 300 VDCW	C220133-80
C3110	Cathode bypass	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3111	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3112	I-f coupling	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3113	Cathode bypass	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3114	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3115	STC time constant	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3116	STC time constant	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3117	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3118	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		CAPACITORS (Continued)	
C3119	Gain decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3120	Gain decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3121	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3122	Gain decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3123	Gain decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3124	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3125	B+ decoupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3126	Detector filter	39 uuf ±10%, mica, 300 VDCW	CM15C390K
C3127	Filament by-pass	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3128	Filament de-coupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3129	Filament de-coupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3130	Filament de-coupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3131	Filament de-coupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3132	Filament de-coupler	1000 uuf ±20%, mica, feedthrough, 500 VDCW	C220336-1
C3133	Coupling	0.1 uf ±20%, paper, 400 VDCW	L220154-70
C3134	Coupling	0.1 uf ±20%, paper, 400 VDCW	L220154-70
C3135	Coupling	0.1 uf ±20%, paper, 400 VDCW	L220154-70
C3136	Coupling	0.1 uf ±20%, paper, 400 VDCW	L220154-70

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		CAPACITORS (Continued)	
C3137	Coupling	10,000 uuf ±10%, mica, 300 VDCW	CM35B103K
C3138	Coupling	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3139	Cathode bypass	0.01 uf ±10%, mica, 500 VDCW	C220178-2
C3140	Crystal-current filter	1000 uuf ±20%, ceramic, standoff, 500 VDCW	C220136-1
C3141	Input tuning	56 uuf ±5%, mica, 300 VDCW	CM15C560J
C3142	Input	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3143	Crystal-current filter	1000 uuf ±20%, ceramic, standoff, 500 VDCW	C220136-1
C3144	Filter B+	1000 uuf ±20%, ceramic, standoff, 500 VDCW	C220136-1
C3146	Discriminator	68 uuf ±5%, mica, 500 VDCW	CM15C680J
C3147	Discriminator	18 uuf ±5%, mica, 300 VDCW	C220132-85
C3148	Plate	0.01 uf ±10%, mica, 300 VDCW	CM35B103K
C3149	Integration	39 uuf ±10%, mica, 500 VDCW	CM15C390K
C3150	Cathode	100 uuf ±10%, mica, 500 VDCW	CM15C101K
C3151	Coupling	0.01 uf ±10%, mica, 300 VDCW	CM35B103K
C3152	Coupling	2700 uuf ±10%, mica, 500 VDCW	CM35B272K
C3153	Coupling	470 uuf ±10%, mica, 300 VDCW	C220133-79
C3154	Feedback	3300 uuf ±10%, mica, 500 VDCW	CM35B332K
C3155	Feedback	3300 uuf ±10%, mica, 500 VDCW	CM35B332K
C3156A, B, C	Filter	3 x 0.1 uf +20%-10%, 600 VDCW	CP69B5EF104V
C3157A, B, C	Filter	3 x 0.1 uf +20%-10%, 600 VDCW	CP69B5EF104V
C3158	Filter	180 uuf ±5%, mica, 300 VDCW	CM15C181K
C3159	Filter	0.01 uf ±10%, mica, 500 VDCW	C220178-2

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		CRYSTAL	
CR3101	Detector	Rectifier, germanium diode	C221944-1
		CABLE CLAMPS	
E3101	Part of W3101	Clamp, cable, coaxial	MX-1530/U
E3102	Part of W3102	Clamp, cable, coaxial	MX-1530/U
E3103	Part of W3103	Clamp, cable, coaxial	MX-1530/U
		JACKS	
J3101	Input alignment	Tip, jack, white	C283750-1
J3102	I-f alignment	Tip, jack, white	C283750-1
J3103	Power	25-pin	C287099-1
J3104	Video #1	Connector, BNC	UG-1094/U
J3105	Video #2	Connector, BNC	UG-1094/U
J3106	AFC pulse	Tip, jack, white	C283750-1
J3107	AFC output	Tip, jack, white	C283750-1
		RELAY	
K3101	Contour ON-OFF	Relay, 28 VDC, DPDT, 4 amp contact	L218814-1
		COILS AND INDUCTORS	
L3101	Crystal-current filter	Choke, 21T #30 HF, resonates 74.1 mmf at 10 mc, approx. 3.41 uh	C215350-53
L3102	Crystal-current filter	Choke, r-f, 14 uh	C215092-6
L3103	Crystal-current filter	Choke, 21T #30 HF, resonantes 74.1 mmf at 10 mc, approx. 3.41 uh	C215350-53
L3104	Crystal-current filter	Choke, r-f, 14 uh	C215092-6
L3105	Input tuning	Choke, 15T #28 HF, approx. 0.5 uh (56.4 mmf at 30 mc)	C215350-56

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		COILS AND INDUCTORS (Continued)	
L3106	Input tuning	Choke, 23.25T #34 HF, adjustable core (2.0 uh - 4.9 uh)	L291814-1
L3107	Neutralize (V3101)	Choke, 42T #34 HF, resonates at 88 mmf at 5 mc, approx. 11.5 uh	C215350-54
L3108	Plate load	Choke, 22T #30 HF, resonates at 70 mmf at 10 mc, approx. 3.5 uh	C215350-55
L3109	Detector filter	Choke, r-f, 14 uh	C215092-6
L3110	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3111	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3112	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3113	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3114	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3115	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3116	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3117	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3118	Filter decoupler	Choke, r-f, 1.1 uh	C215092-5
L3122	Filter, crystal current	21T #30 HF, resonates 74.1 uuf at 10 mc, approx. 3.41 uh	C215350-53
L3123	Input tuning	21T #30 HF, resonates 74.1 uuf at 10 mc, approx. 3.41 uh	C215350-53
L3124	Input tuning	15T #28 HF, resonates 56.4 uuf at 30.0 mc, approx. 0.5 uh	C215350-56
L3125	Load	Coil, 14.5T #30 HF, adjustable core 1.25 - 2.05 uh	L216237-1
L3126	Discriminator	Coil, 11.5T #30 HF, adjustable core 0.906 - 1.82 uh	L216237-2
		PLUGS	
P3101	Part of W3101	Connector, BNC, coax angle	C223390-19
P3102	Part of W3102	Connector, BNC, coax angle	C223390-19
P3103	Part of W3103	Connector, BNC, coax angle	C223390-19

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		RESISTORS	
R3101	Cathode bias	220 ohms ±10%, 1/2w, comp	RC20GF221K
R3102	Cathode bias	220 ohms ±10%, 1/2w, comp	RC20GF221K
R3103	B+ decoupler	1000 ohms ±10%, 1/2w, comp	RC20GF102K
R3104	STC decoupler	1000 ohms ±10%, 1/2w, comp	RC20GF102K
R3105	Loading	2200 ohms ±10%, 1/2w, comp	RC20GF222K
R3106	B+ decoupler	390 ohms ±10%, 1/2w, comp	RC20GF391K
R3107	B+ decoupler	390 ohms ±10%, 1/2w, comp	RC20GF391K
R3108	Cathode bias	82 ohms ±10%, 1/2w, comp	RC20GF820K
R3109	Screen decoupler	150 ohms ±10%, 1/2w, comp	RC20GF151K
R3110	Loading	6800 ohms ±10%, 1/2w, comp	RC20GF682K
R3111	Cathode bias	82 ohms ±10%, 1/2w, comp	RC20GF820K
R3112	B+ decoupler	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3113	Bias decoupler	390 ohms ±10%, 1/2w, comp	RC20GF391K
R3114	Bias decoupler	390 ohms ±10%, 1/2w, comp	RC20GF391K
R3115	Bias decoupler	390 ohms ±10%, 1/2w, comp	RC20GF391K
R3116	Screen decoupler	150 ohms ±10%, 1/2w, comp	RC20GF151K
R3117	B+ decoupler	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3118	Loading	6800 ohms ±10%, 1/2w, comp	RC20GF682K
R3119	Cathode bias	82 ohms ±10%, 1/2w, comp	RC20GF820K
R3120	Screen decoupler	150 ohms ±10%, 1/2w, comp	RC20GF151K
R3121	B+ decoupler	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3122	Loading	6800 ohms ±10%, 1/2w, comp	RC20GF682K
R3123	Cathode bias	82 ohms ±10%, 1/2w, comp	RC20GF820K
R3124	Screen decoupler	150 ohms ±10%, 1/2w, comp	RC20GF151K
R3125	Detector load	3900 ohms ±10%, 1/2w, comp	RC20GF392K
R3126	Coupling	470K ohms ±10%, 1/2w, comp	RC20GF474K

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		RESISTORS (Continued)	
R3127	Cathode	220 ohms ±10%, 1/2w, comp	RC20GF221K
R3128	Plate load	15K ohms ±10%, 1/2w, comp	RC20GF153K
R3129	Grid	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3130	Divider	82K ohms ±10%, 1/2w, comp	RC20GF823K
R3131	Divider	100K ohms ±10%, 2w, comp	RC42GF104K
R3132	Contour adjust	50K ohms ±20%, 1/3w, comp, variable	L219668-1
R3133	Divider	390K ohms ±10%, 1/2w, comp	RC20GF394K
R3134	Divider	560K ohms ±5%, 1/2w, comp	RC20GF564J
R3135	Cathode	5600 ohms ±5%, 1/2w, comp	RC20GF562J
R3136	Plate load	15K ohms ±10%, 1/2w, comp	RC20GF153K
R3137	Divider	270K ohms ±10%, 1/2w, comp	RC20GF274K
R3138	Grid	56K ohms ±10%, 1/2w, comp	RC20GF563K
R3139	Grid	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3140	Cathode	2700 ohms ±10%, 1/2w, comp	RC20GF272K
R3141	Plate load	8200 ohms ±10%, 1/2w, comp	RC20GF822K
R3142	Divider	270K ohms ±5%, 1/2w, comp	RC20GF274J
R3143	Divider	8200 ohms ±5%, 1/2w, comp	RC20GF822J
R3144	Grid	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3145	Cathode	2200 ohms ±10%, 1/2w, comp	RC20GF222K
R3146	Cathode	2200 ohms ±10%, 1/2w, comp	RC20GF222K
R3147	Grid	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3148	Divider	390K ohms ±10%, 1/2w, comp	RC20GF394K
R3149	STC depth	50K ohms ±20%, 1/3w, comp, variable	L219668-1
R3150	Divider	180K ohms ±10%, 1/2w, comp	RC20GF184K
R3151	Divider	33K ohms ±10%, 1/2w, comp	RC20GF333K
R3152	Grid limiter	4700 ohms ±10%, 1/2w, comp	RC20GF472K

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		RESISTORS (Continued)	
R3153	Plate load	56K ohms ±10%, 1/2w, comp	RC20GF563K
R3154	Filter	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3155	Filter	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3156	Plate load	10K ohms ±10%, 1/2w, comp	RC20GF103K
R3157	Cathode	180 ohms ±10%, 1/2w, comp	RC20GF181K
R3158	Grid	4700 ohms ±10%, 1/2w, comp	RC20GF472K
R3159	Grid	4700 ohms ±10%, 1/2w, comp	RC20GF472K
R3160	Cathode	10K ohms ±10%, 1/2w, comp	RC20GF103K
R3161	Plate load	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3162	Plate load	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3163	Plate load	8200 ohms ±10%, 2w, comp	RC42GF822K
R3164	Grid	22K ohms ±10%, 1/2w, comp	RC20GF223K
R3165	Cathode	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3166	Load	2.2 megohms ±10%, 1/2w, comp	RC20GF225K
R3167	Grid	2.2 megohms ± 10%, 1/2w, comp	RC20GF225K
R3168	Divider	3.9 megohms ±10%, 1/2w, comp	RC20GF395K
R3169	Suppressor	2.2 megohms ±10%, 1/2w, comp	RC20GF225K
R3170	Plate	1 megohm ±10%, 1/2w, comp	RC20GF105K
R3171	Divider	270K ohms ±10%, 1/2w, comp	RC20GF274K
R3172	Divider	680K ohms ±10%, 1/2w, comp	RC20GF684K
R3173	Sweep adjust	1 megohm ±20%, 1/3w, comp, variable	L219668-2
R3174	Divider	820K ohms ±10%, 1/2w, comp	RC20GF824K
R3175	Divider	68K ohms ±10%, 1/2w, comp	RC20GF683K
R3176	Divider	18K ohms ±10%, 1/2w, comp	RC20GF183K
R3177	Divider	470K ohms ±10%, 1/2w, comp	RC20GF474K
R3178	Filter	100 ohms ±10%, 1/2w, comp	RC20GF101K

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		RESISTORS (Continued)	
R3179	Filter	100 ohms ±10%, 1/2w, comp	RC20GF101K
R3180	Discriminator load	8200 ohms ±10%, 1/2w, comp	RC20GF822K
R3181	I-f gain adjust (coarse)	2500 ohms ±20%, 1/3w, comp, variable	L219668-6
R3182	Divider	1.0 megohm ±10%, 1/2w, comp	RC20GF105K
		TRANSFORMERS	
T3101	Interstage	Pri: 3 & 4 15-1/4T #32 HF, 2 layers Sec: 1 & 2 15-3/4T #32 HF	L291814-2
T3102	Interstage	Pri: 3 & 4 15-1/4T #32 HF, 2 layers Sec: 1 & 2 15-3/4T #32 HF	L291814-2
T3103	Interstage	Pri: 3 & 4 15-1/4T #32 HF, 2 layers Sec: 1 & 2 15-3/4T #32 HF	L291814-2
T3104	Interstage	Pri: 3 & 4 15-1/4T #32 HF, 2 layers Sec: 1 & 2 15-3/4T #32 HF	L291814-2
T3105	Interstage	Pri: 3 & 4 19-1/4T #32 HF, 2 layers Sec: 1 & 2 19-3/4T #32 HF	L291814-3
		ELECTRON TUBES	
V3101	Cascode, low noise, i-f amplifier	Tube, electron, twin triode, type 5670	5670
V3102	STC controlled i-f amplifier	Tube, electron, sharp cut-off r-f pentode, type 6136	6136
V3103	Gain controlled i-f amplifier	Tube, electron, sharp cut-off r-f pentode, type 6136	6136
V3104	Gain controlled i-f amplifier	Tube, electron, sharp cut-off r-f pentode, type 6136	6136
V3105	I-f amplifier	Tube, electron, sharp cut-off r-f pentode, type 6136	6136

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		ELECTRON TUBES (Continued)	
V3106	Video amplifier(A) Video amplifier(B)	Tube, electron, high mu, twin triode, type 5751	5751
V3107	Contour (A) Video amplifier(B)	Tube, electron, high-mu, twin triode, type 5751	5751
V3108	Cathode follower video output	Tube, electron, medium-mu, twin triode, type 5687	5687
V3109	Clamp (A) STC (B)	Tube, electron, medium-mu, twin triode, type 5814	5814
V3110	I-f amplifier	Tube, electron, sharp cut-off r-f pentode, type 5654	5654
V3111	Discriminator	Tube, electron, high-mu, twin triode, type 5751	5751
V3112	Amplifier, pulse	Tube, electron, high frequency, twin triode, type 6201/12AT7WA	6201/12AT7WA
V3113	Clamp	Tube, electron, twin diode, type 5726	5726
V3114	Sweep Generator	Tube, electron, dual control r-f pentode, type 5725	5725
		CABLE ASSEMBLIES	
W3101	Signal input	Assembly, coax, RG-71, 9", with P3101 and E3101	L212935-3
W3102	Signal input	Assembly, coax, RG-71, 9", with P3102 and E3102	L212935-5
	Adaptor	Coax angle adaptor, W3102 to J3005	UG-306/U
W3103	AFC input	Assembly, coax, RG-71, 14", with P3103 and E3103	L212935-4
		SOCKETS	
XV3101	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3102	Tube socket	7-pin, with 1000-mmf ceramic capacitors built in at pins 2, 3, 4, 6, 7	C223267-2

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		SOCKETS (Continued)	
XV3103	Tube socket	7-pin, with 1000-mmf ceramic capacitors built in at pins 2,3,4,6,7	C223267-2
XV3104	Tube socket	7-pin, with 1000-mmf ceramic capacitors built in at pins 2, 3, 4, 6, 7	C223267-2
XV3105	Tube socket	7-pin, with 1000-mmf ceramic capacitors built in at pins 2,3,4,6,7	C223267-2
XV3106	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3107	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3108	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3109	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3110	Tube socket	7-pin, with 1000-mmf ceramic capacitors built in at pins 2,3,4,6,7	C223267-2
XV3111	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3112	Tube socket	9-pin miniature, mica filled, phenolic	C223103-1
XV3113	Tube socket	7-pin miniature, mica filled, phenolic	C287019-2
XV3114	Tube socket	7-pin miniature, mica filled, phenolic	C287019-2
		FILTERS	
Z3101	Filter i-f	LR combination, AR at 30 mc	C215718-2
Z3102	Filter i-f	LR combination, AR at 30 mc	C215718-2
		MISCELLANEOUS REPLACEABLE PARTS	
		Cover, assembly, receiver-afc chassis bottom	L283503-1
		Pin, hinge, receiver-afc chassis	C295787-1
		Shield, i-f amplifier section cover	L693119-1
		Screw, receiver-afc chassis mounting	C295544-2
		Shield, tube (for V3102, V3103, V3104, V3105)	C678157-1

ELECTRICAL PARTS LIST
TYPE RDR-1C TRANSMITTER-RECEIVER (RECEIVER-AFC SECTION) (Continued)

SYMBOL DESIG-NATION	FUNCTION	NAME OF PART AND DESCRIPTION	BENDIX PART NUMBER
		MISCELLANEOUS REPLACEABLE PARTS (Continued)	
		Shield, tube (for V3106, V3107, V3108, V3109, V3111, V3112)	C678157-2
		Shield, tube (for V3110, V3113, V3114)	C678157-3
		Shield, tube (for V3101)	C678157-4
		Stud, terminal, insulated standoff	C678039-1

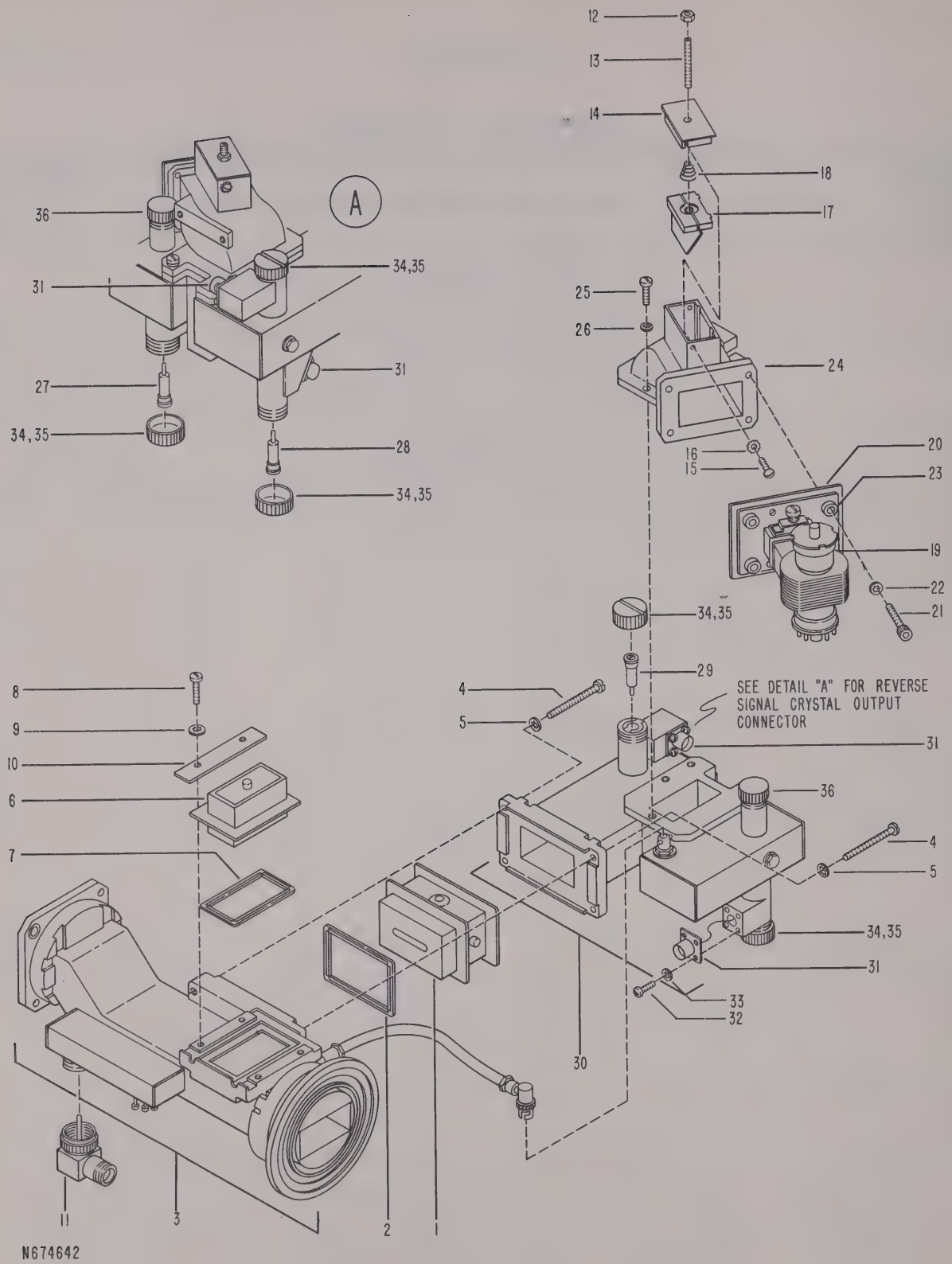


Figure 8-1. Duplexer-Mixer Waveguide Assembly W3001, Part of RDR-1C Transmitter-Receiver, Exploded View

GROUP ASSEMBLY PARTS LIST FOR FIGURE 8-1

DUPLEXER-MIXER ASSEMBLY W3001

Reference No.	Airtron Part Number	Description	Quantity Required
	66586*	DUPLEXER-MIXER ASSEMBLY W3001	
1		Tube, TR Type 6624 (V3007)	1
2	54634	Gasket Assembly, RF and Pressure	1
3	66065	Duplexer Assembly	1
		(Attaching Parts)	
4	A-26713	Screw	4
5	AN-936A-8	Lockwasher	4
6		Tube, ATR Type 6591 (V3005)	1
7	54634	Gasket Assembly, RF and Pressure	1
		(Attaching Parts)	
8	AN-500C8-6	Screw	4
9	AN-936A-8	Lockwasher	4
10	66659	Clamp	2
11	66075	Connector, Type N Right Angle	1
12	AN-340C10	Nut, Locking	1
13	64938	Screw, L.O. Attenuator Adjusting	1
14	64939	Cover, L.O. Attenuator	1
		(Attaching Parts)	
15	A21225-E	Screw	2
16	AN-936B-4	Lockwasher	2
17	64940	Blade Assembly, L.O. Attenuator	1
18	64941	Spring	1
19		Tube, Klystron Type VA-221-H, (V3008)	1
20	500077	Insulator, Mica	1
		(Attaching Parts)	
21	A-28612	Screw, Allen Head Cap	4

*Bendix Part Number N244229-1

GROUP ASSEMBLY PARTS LIST FOR FIGURE 8-1
DUPLEXER-MIXER ASSEMBLY W3001 (Continued)

Reference No.	Airtron Part Number	Description	Quantity Required
		DUPLEXER-MIXER ASSEMBLY W3001 (Cont.)	
22	AN-936A-6	Lockwasher	4
23	63042	Insulator, Nylon	4
24	60673	Arm, L.O. Feed	1
		(Attaching Parts)	
25	AN-500C8-8	Screw	4
26	AN-936A-8	Lockwasher	4
27		Crystal, AFC, Type 1N23CR (CR3006)	1
28		Crystal, Signal, Type 1N23CR (CR3005)	1
29		Crystal, Signal, Type 1N23C (CR3004)	1
30	66640	Mixer Assembly	1
31	26008	Connector, BNC	3
		(Attaching Parts)	
32	AN-500C4-4	Screw	12
33	AN-936A-4	Lockwasher	12
34	51931	Cap, Crystal Mount	3
35	17453	Insert, Crystal Mount Cap	3
36	A51932	Cap	1

SECTION IX
SCHEMATIC DIAGRAMS

This section contains the following schematic diagrams of the RDR-1C Transmitter-Receiver.

SECTION	DRAWING NUMBER	FIGURE NUMBER
Modulator-Transmitter	OR669785	9-1
Receiver-afc	OR669789	9-2

An additional, reproducible copy of each of the above listed schematic diagrams is included at the end of this section.

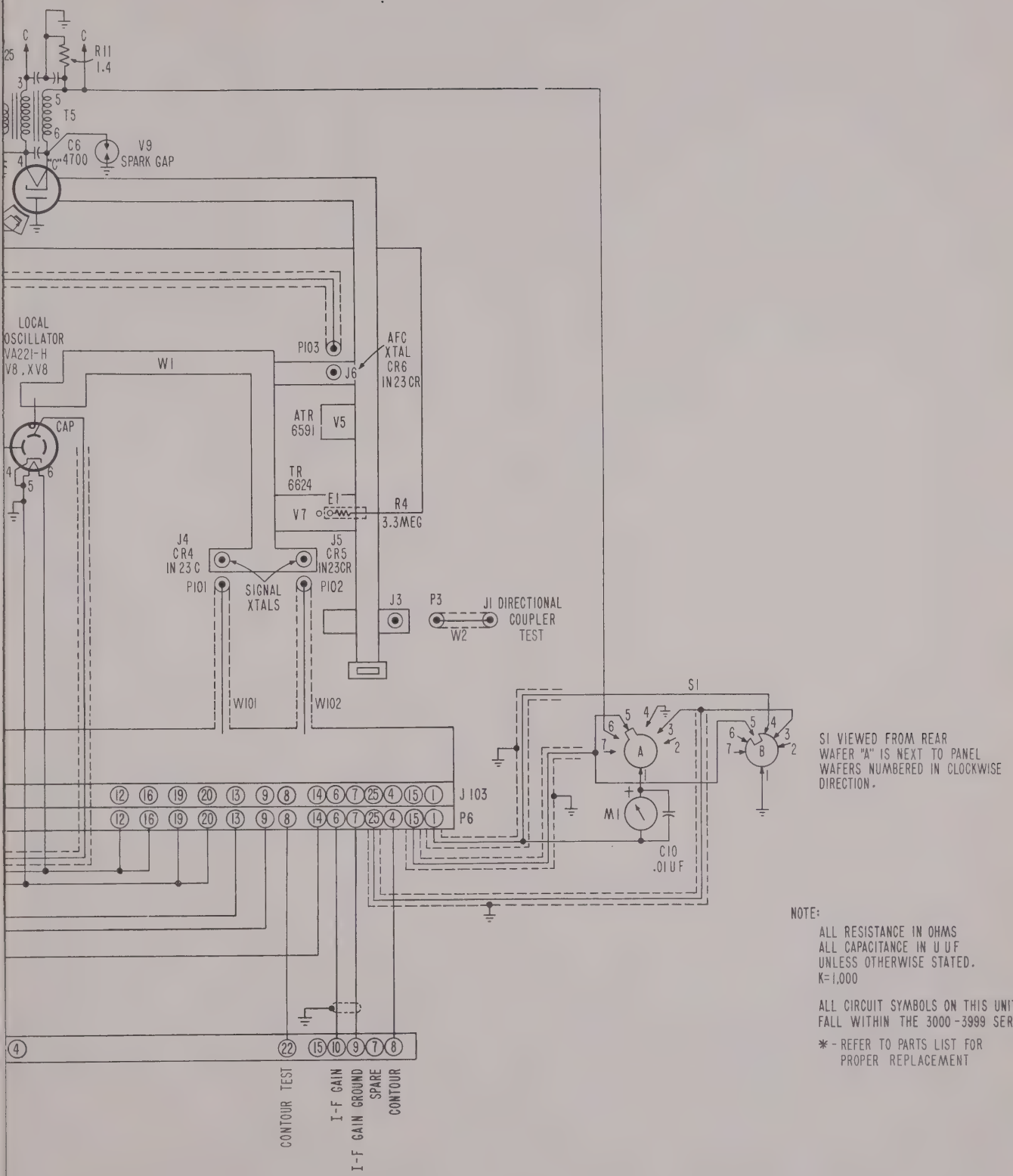
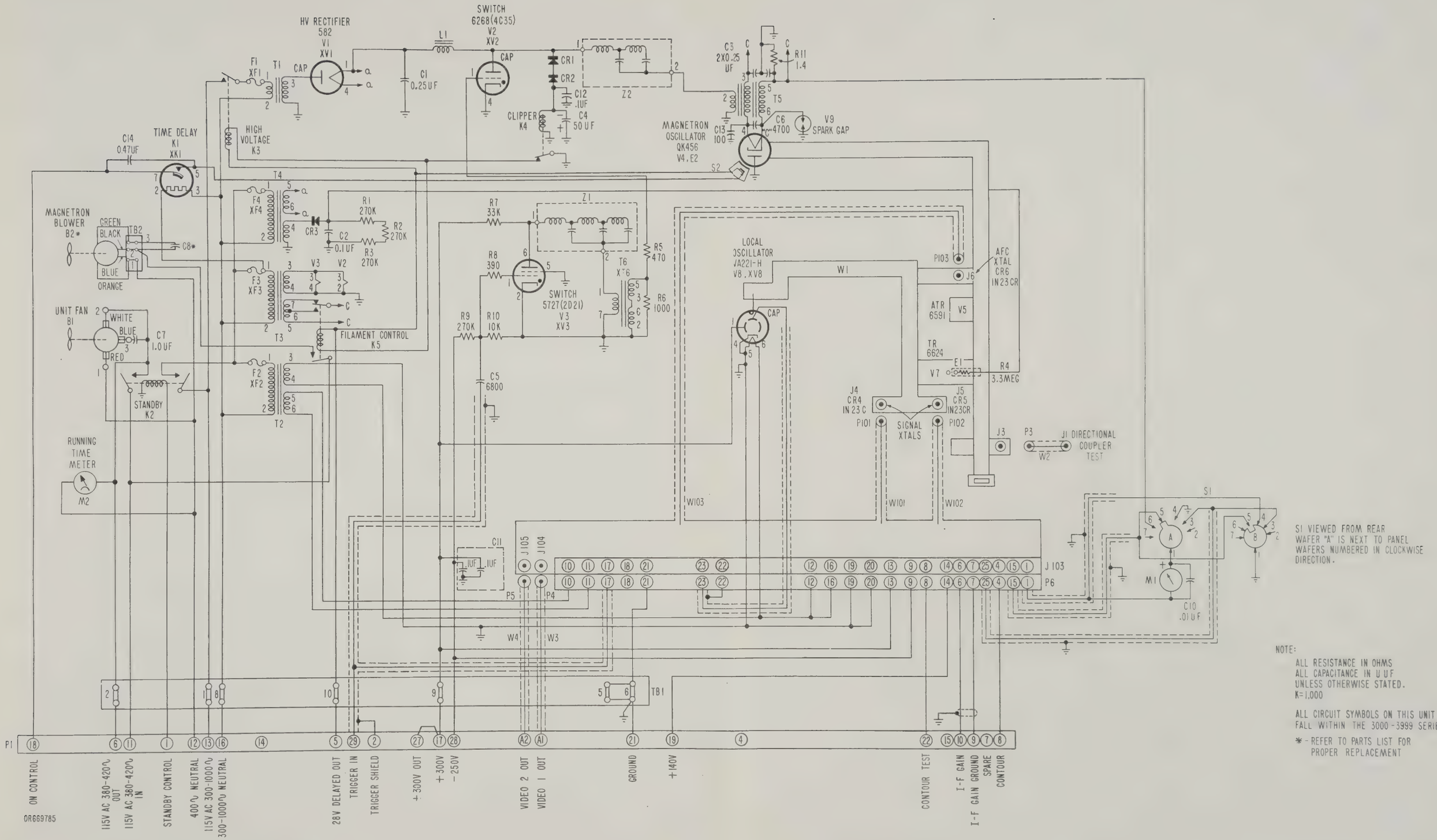


Figure 9-1. Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Schematic Diagram



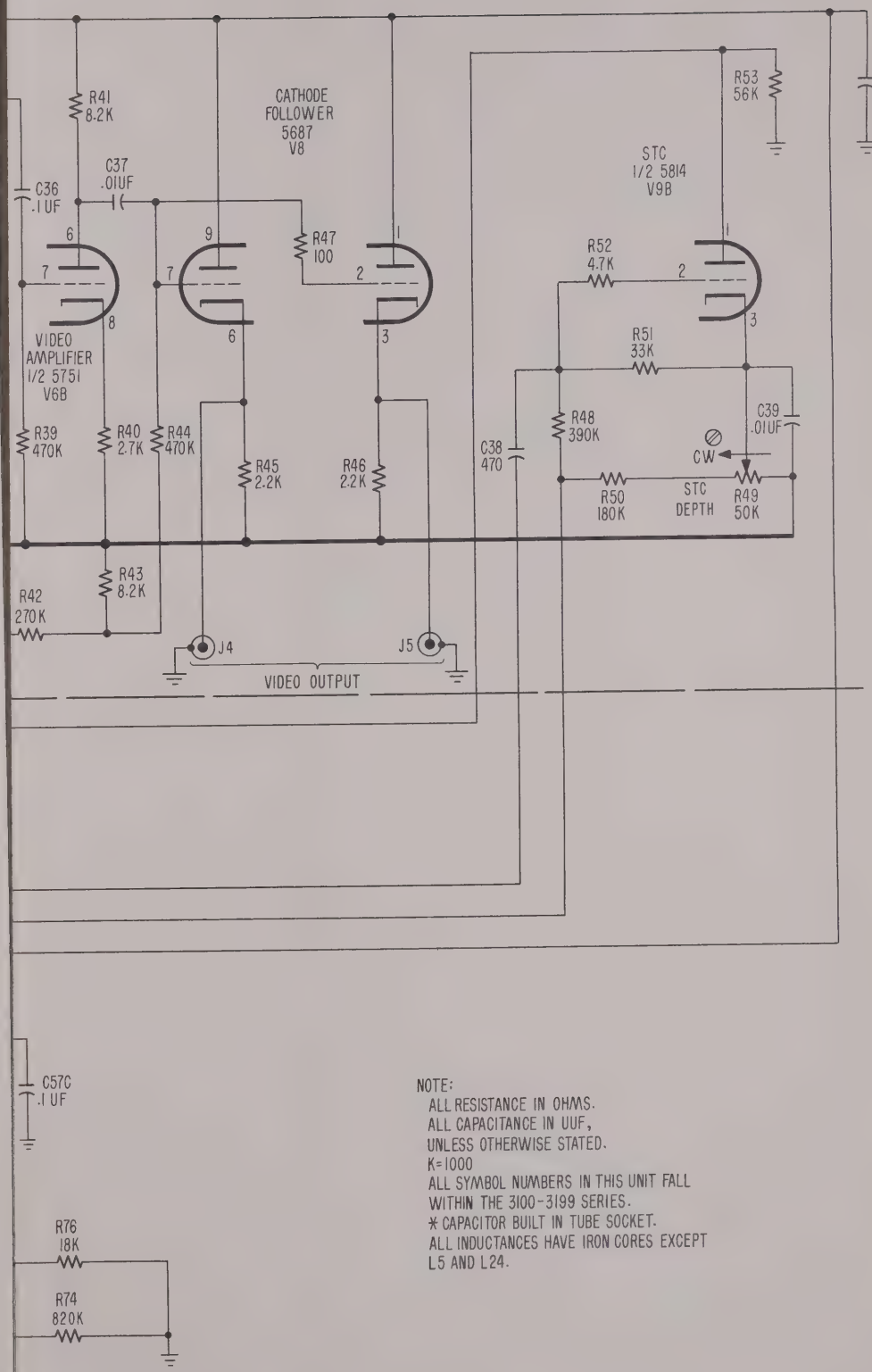
NOTE:

ALL RESISTANCE IN OHMS
ALL CAPACITANCE IN U UF
UNLESS OTHERWISE STATED.
K=1,000

ALL CIRCUIT SYMBOLS ON THIS UNIT FALL WITHIN THE 3000-3999 SERIES.

* - REFER TO PARTS LIST FOR PROPER REPLACEMENT

Figure 9-1. Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Schematic Diagram



NOTE:
ALL RESISTANCE IN OHMS.
ALL CAPACITANCE IN UUF,
UNLESS OTHERWISE STATED.
K=1000
ALL SYMBOL NUMBERS IN THIS UNIT FALL
WITHIN THE 3100-3199 SERIES.
* CAPACITOR BUILT IN TUBE SOCKET.
ALL INDUCTANCES HAVE IRON CORES EXCEPT
L5 AND L24.

Figure 9-2. Receiver-Afc Section of RDR-1C Transmitter-Receiver, Schematic Diagram

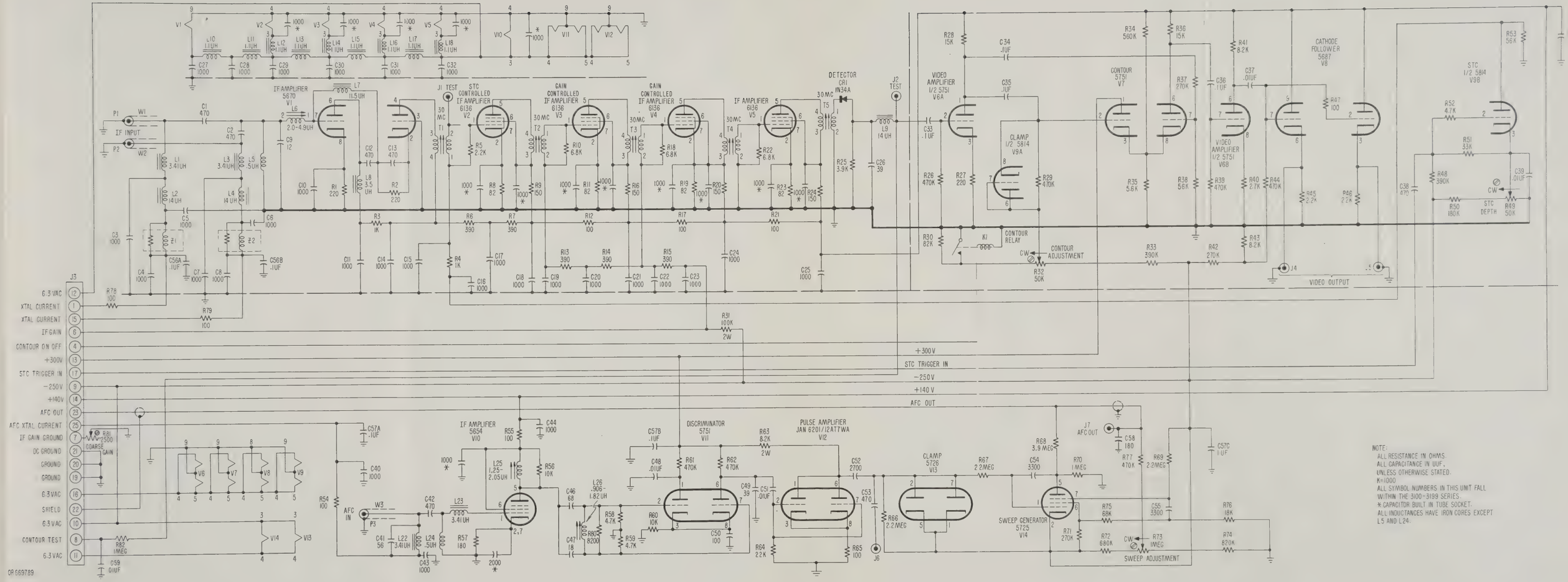


Figure 9-2. Receiver-Afc Section of RDR-1C Transmitter-Receiver, Schematic Diagram

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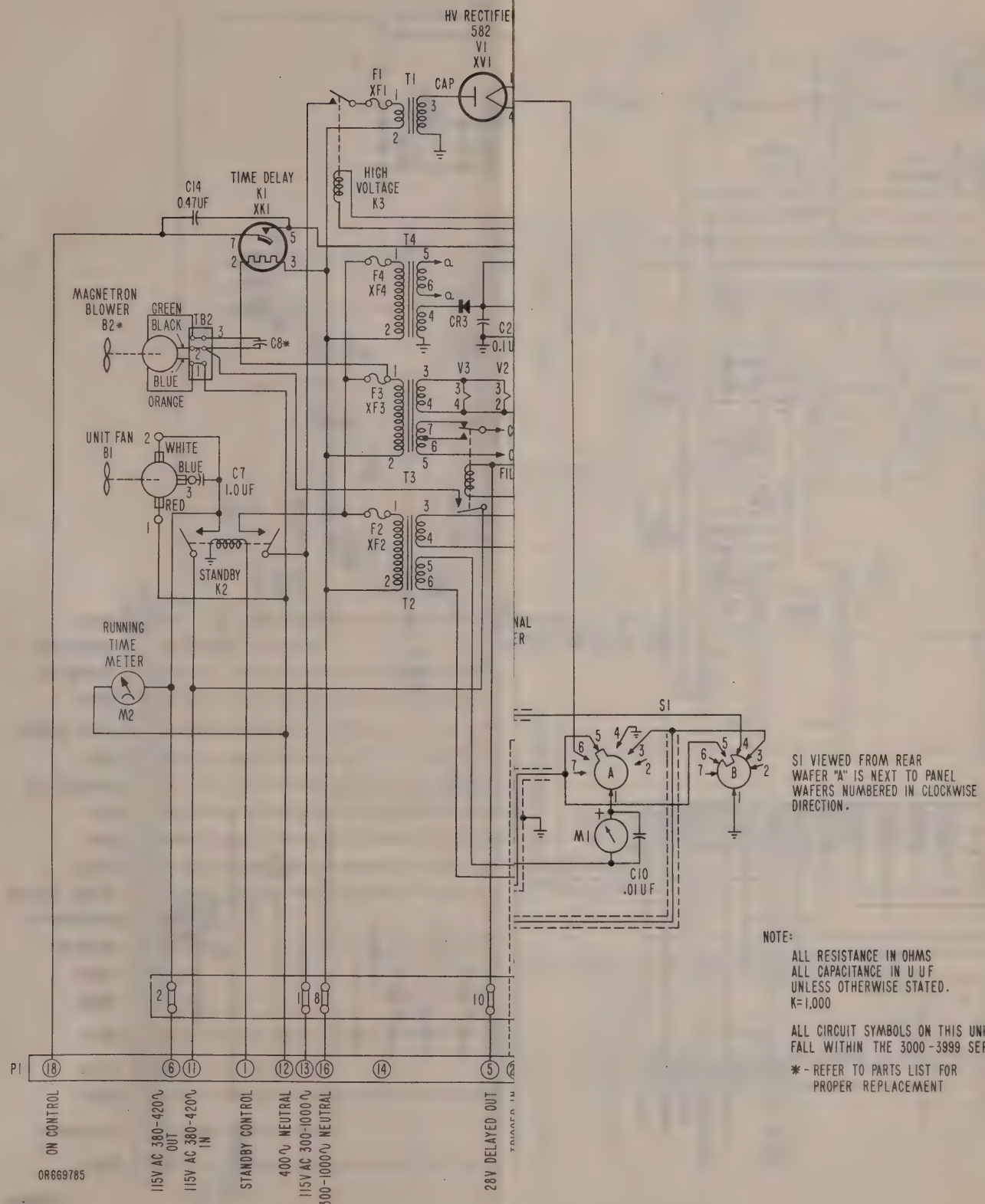
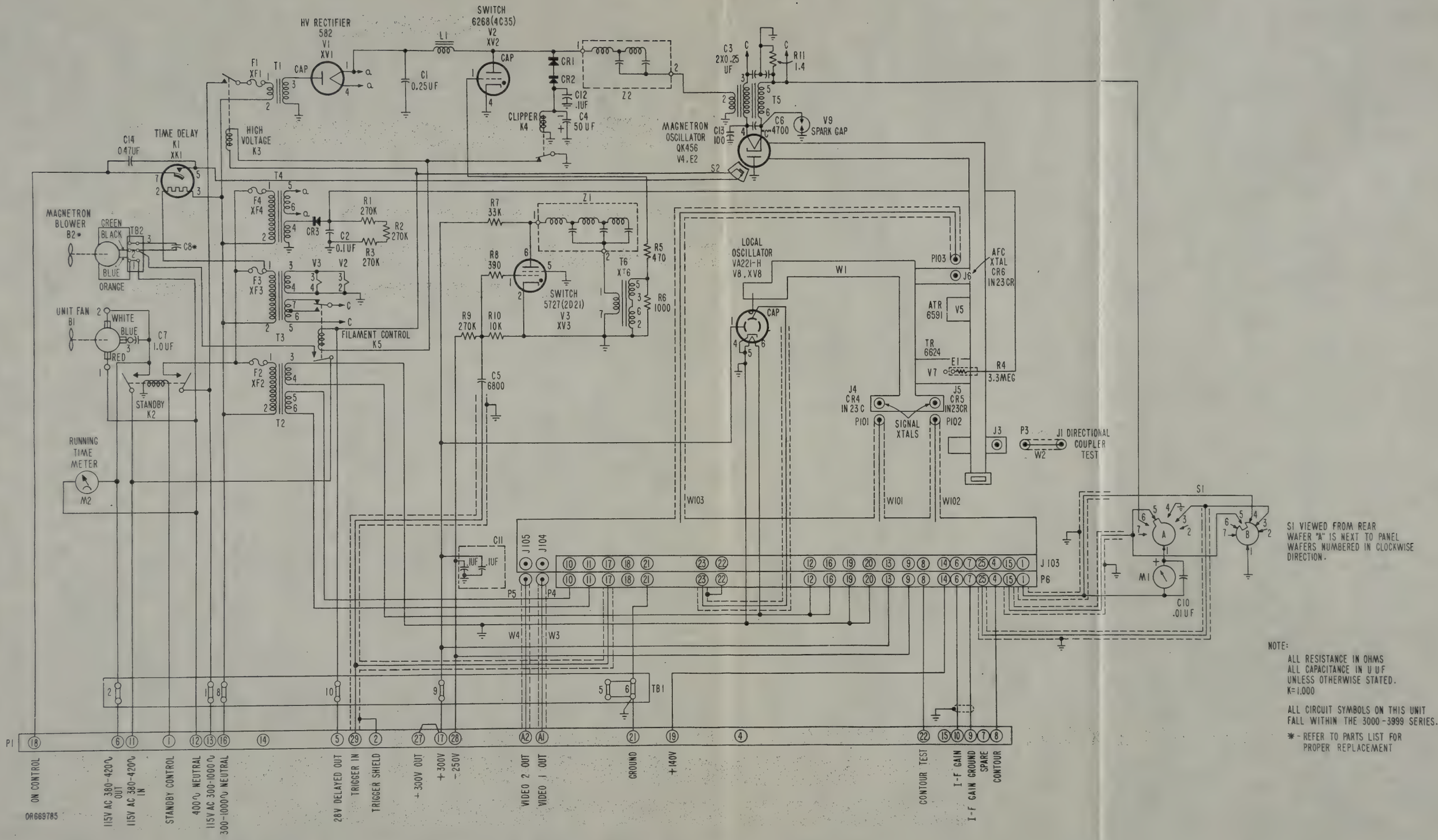
REPRODUCIBLE DIAGRAMS

The following, reproducible, schematic diagrams are printed on vellum and are perforated along their binding edge for easy removal.



ter Section of RDR-1C Transmitter-Receiver,
Schematic Diagram



S1 VIEWED FROM REAR
WAFER "A" IS NEXT TO PANEL
WAFERS NUMBERED IN CLOCKWISE DIRECTION.

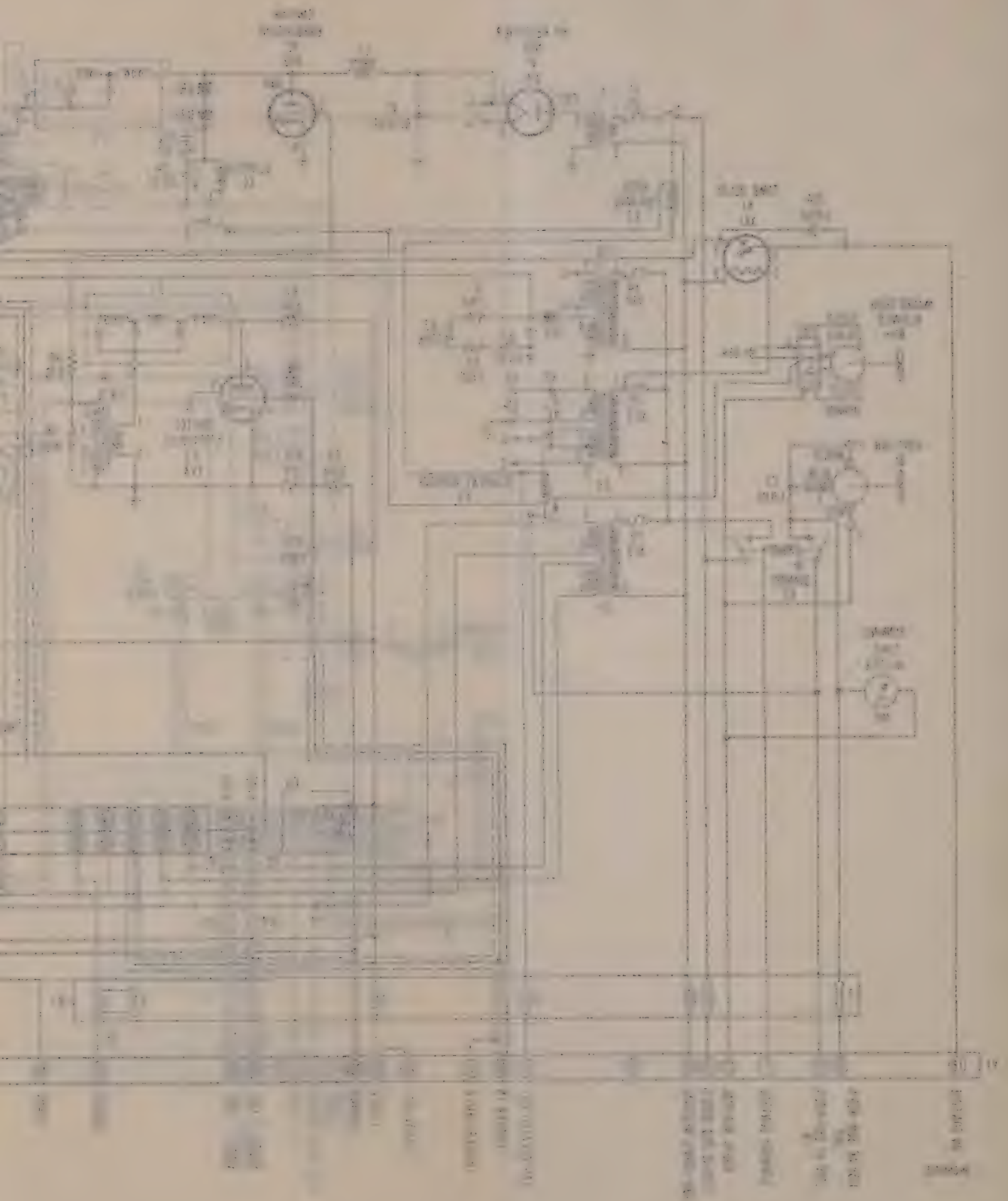
NOTE:

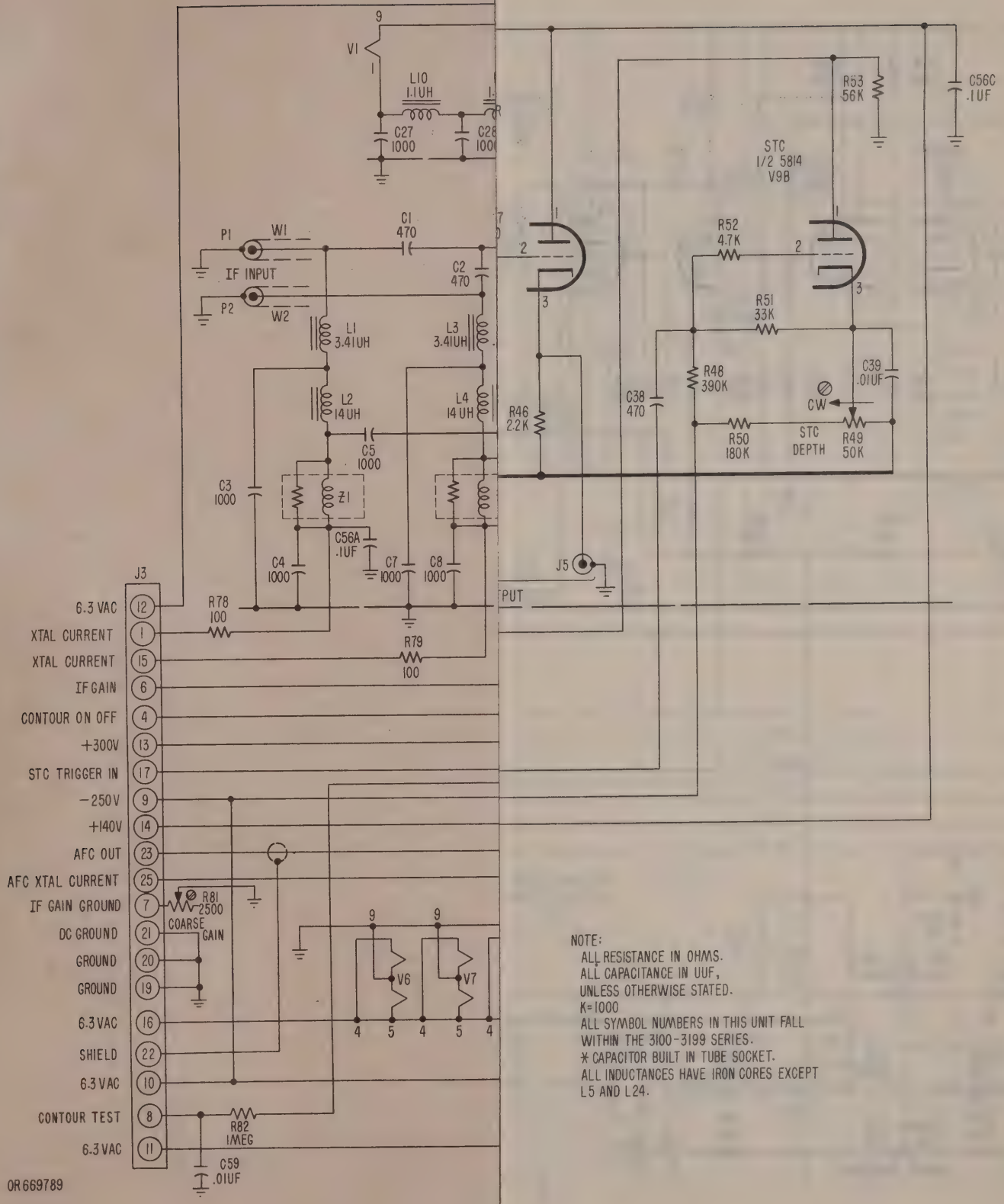
ALL RESISTANCE IN OHMS
ALL CAPACITANCE IN U U F
UNLESS OTHERWISE STATED.
K=1.000

ALL CIRCUIT SYMBOLS ON THIS UNIT FALL WITHIN THE 3000-3999 SERIES.

* - REFER TO PARTS LIST FOR PROPER REPLACEMENT

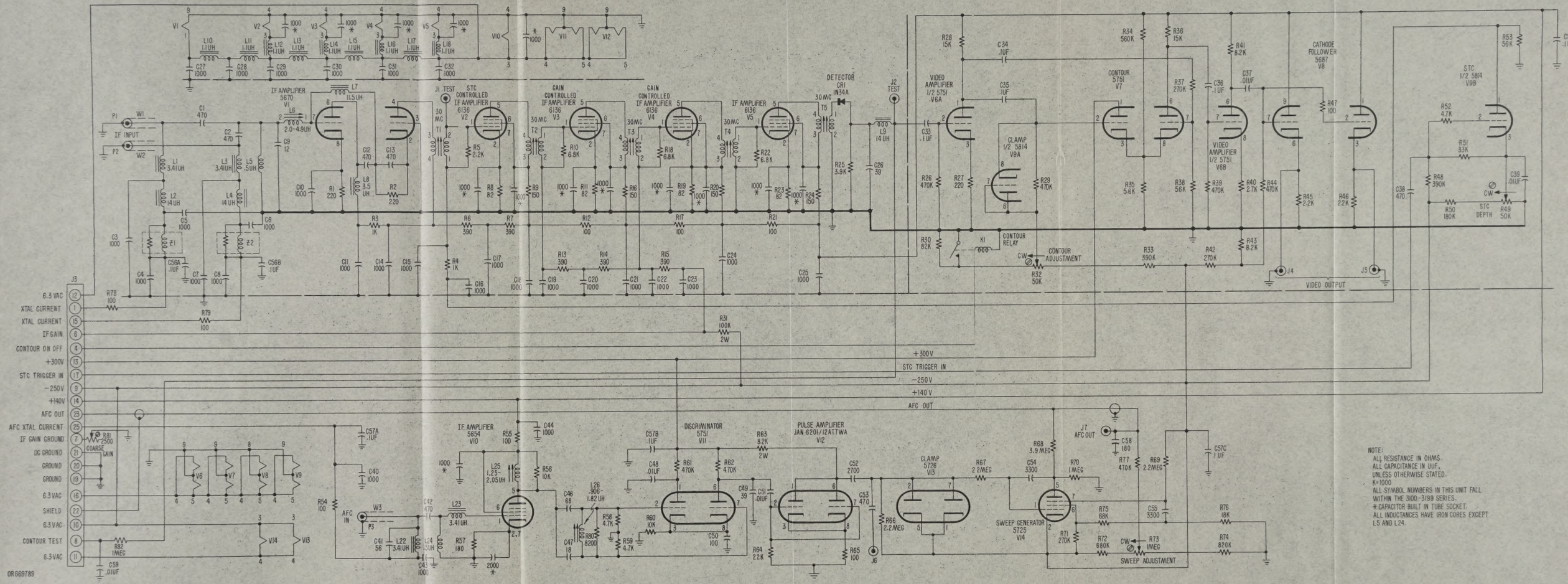
Figure 9-1. Modulator-Transmitter Section of RDR-1C Transmitter-Receiver, Schematic Diagram





NOTE:
ALL RESISTANCE IN OHMS.
ALL CAPACITANCE IN UUF,
UNLESS OTHERWISE STATED.
K=1000
ALL SYMBOL NUMBERS IN THIS UNIT FALL
WITHIN THE 3100-3199 SERIES.
* CAPACITOR BUILT IN TUBE SOCKET.
ALL INDUCTANCES HAVE IRON CORES EXCEPT
L5 AND L24.

Afc Section of RDR-1C Transmitter-Receiver, Schematic Diagram



NOTE:
ALL RESISTANCE IN OHMS.
ALL CAPACITANCE IN UUF, UNLESS OTHERWISE STATED.
K=1000
ALL SYMBOL NUMBERS IN THIS UNIT FALL WITHIN THE 3100-3199 SERIES.
*CAPACITOR BUILT IN TUBE SOCKET.
ALL INDUCTANCES HAVE IRON CORES EXCEPT L5 AND L24.

Figure 9-2. Receiver-Afc Section of RDR-1C Transmitter-Receiver, Schematic Diagram

J3
6.3 VAC
XTAL CURRENT
XTAL CURRENT
IF GAIN
CONTOUR ON OFF
+300V
STC TRIGGER IN
−250V
+150V
AFC OUT
AFC XTAL CURRENT
IF GAIN GROUND
DC GROUND
GROUND
GROUND
6.3VAC
SHIELD
6.3VAC
CONTOUR TEST
6.3VAC
IF INPUT
IF AMPLIFIER
CONTROL
TEST
COARSE GAIN
AFC
R78 100
R79 100
R81 2500
R82 1MEG
C59 .01UF
C59A .1UF
C59B .1UF
C57A .1UF
R84 100
1000
470
220
360
1K
2.2K
180
3.9UH
14 UH
3.5 UH
5.6UH
1.5UH
2.0-4.8UH
1.1UH
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
W1
W2
P1
P2
P3
P4
P5
09659789

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DIVISION OF BENDIX AVIATION CORPORATION

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